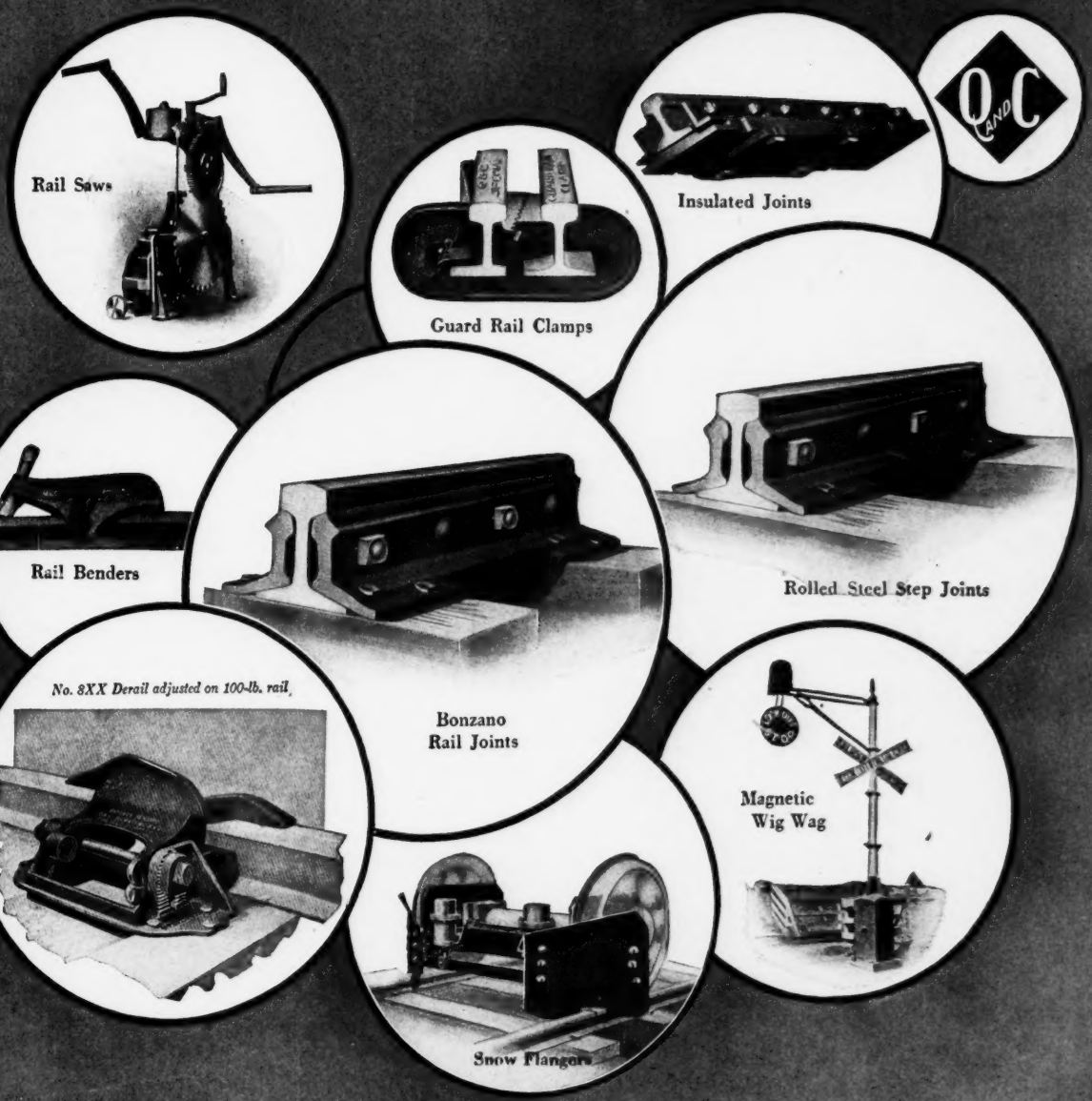
Railway Maintenance Engineer

Volume 12 | CHICAGO: Transportation Building NEW YORK: Woolworth Building | JUNE, 1916 | CLEVELAND: Citizens' Building LONDON: Queen Anne's Chambers | Number

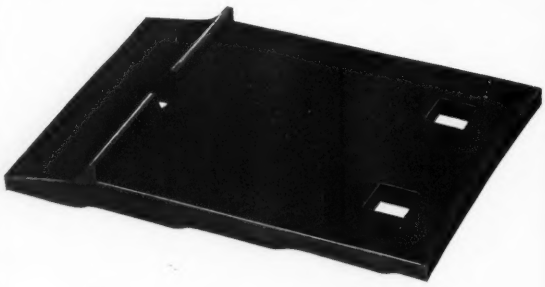


The Best Maintenance of Way Devices

the fact that they are standard on many of our large railway systems is the best argument that can be offered as to their safety and labor-saving qualities and general efficiency. Illustrated, descriptive catalog on request.

The Q & C Company

New York Chicago



More than a mere Tie Plate—A safety device—An economic device—A device promoting easy riding Track. The

LUNDIE TIE PLATE

will more than pay for itself in saving of Rail and Wheel wear and in reduction of maintenance expense, as well as performing the usual functions of a Tie Plate.

JOHN LUNDIE, 52 Broadway, NEW YORK

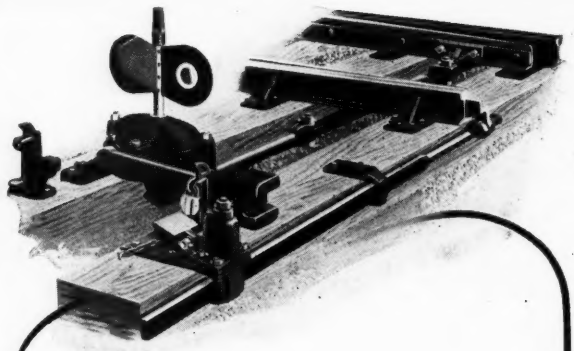
KILBY
FROG & SWITCH
COMPANY

Birmingham, Alabama

Manufacturers of

Frogs, Switches,
Crossings, Etc.

Manganese Track Work
a Specialty



THE ANDERSON SAFETY SWITCH LOCK

Guarantees Safety
Because:

The latch cannot be padlocked **unless the switch is properly closed** and **interlocked.**

The switch will not open under traffic if switch is disconnected from switch stand.

The switch will not open under traffic if the switch stand is knocked down or destroyed.

Is Practical
Because:

The switch, interlock and target are operated by one lever in one movement, consequently:—

It requires no more time or effort in opening or closing the switch than the ordinary stand.

The interlock is independent of the switch stand, but operated with it.

Parts are entirely housed and positively protected from snow and ice.

Is Economical
Because:

First cost is relatively low.

Simplicity in design and sturdy construction insure low maintenance cost.

Safe switches mean a great saving in all equipment.

Write NOW for your copy of our booklet, which describes this safety lock in detail.

The American Valve & Meter Co.
CINCINNATI, OHIO

Ramapo

MANGANESE TRACK WORK A SPECIALTY

AUTOMATIC SAFETY SWITCH STANDS

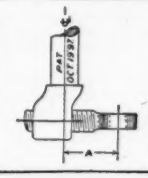
1. **POSITIVE THROW.**—Ramapo Safety Switch Stands are rigid for hand operation. The operator raises the handle, thereby releasing the spindle from the automatic mechanism, then throws the switch, but cannot lower the handle or relock switch unless the points are fully thrown.

2. **AUTOMATIC SAFETY FEATURES.**—A train or car can trail through a switch when set wrong, locked with a Ramapo Safety Switch Stand, without breaking the switch points or injuring the switch stand. The first pair of wheels forces the switch points open, compressing springs in the switch stand, and when points are half way thrown the springs snap the points the rest of the way. The stand is left locked in new position, just as if thrown by hand, and is again ready for either hand or automatic operation.

3. **ADJUSTABLE FEATURES.**—All Ramapo Safety Switch Stands are furnished with adjustable throw and adjustable moving-rods, unless otherwise ordered. Adjustable switch rods are not required, as either switch point can be adjusted. The throw can always be adjusted to suit that of any switch, one-half turn of the eye-bolt crank affecting the throw one-twelfth of an inch. See table of crank adjustments below. The distance of stand from switch can be readily adjusted with the adjustable moving-rod without moving the stand on the ties.

CRANK ADJUSTMENTS FOR RAMAPO SAFETY SWITCH STANDS

THROW OF STAND	"A"	THROW OF STAND	"A"
3½"	2 11/12"	4½"	3"
3⅝"	2 1/12"	4⅝"	3 1/12"
3¾"	2 1/12"	4¾"	3 1/12"
3⅞"	2⅛"	4⅞"	3 1/12"
4"	2 1/12"	4⅞"	3 11/12"
4⅛"	2 1/12"	4⅞"	3 1/12"
4¼"	3"	5"	3 11/12"



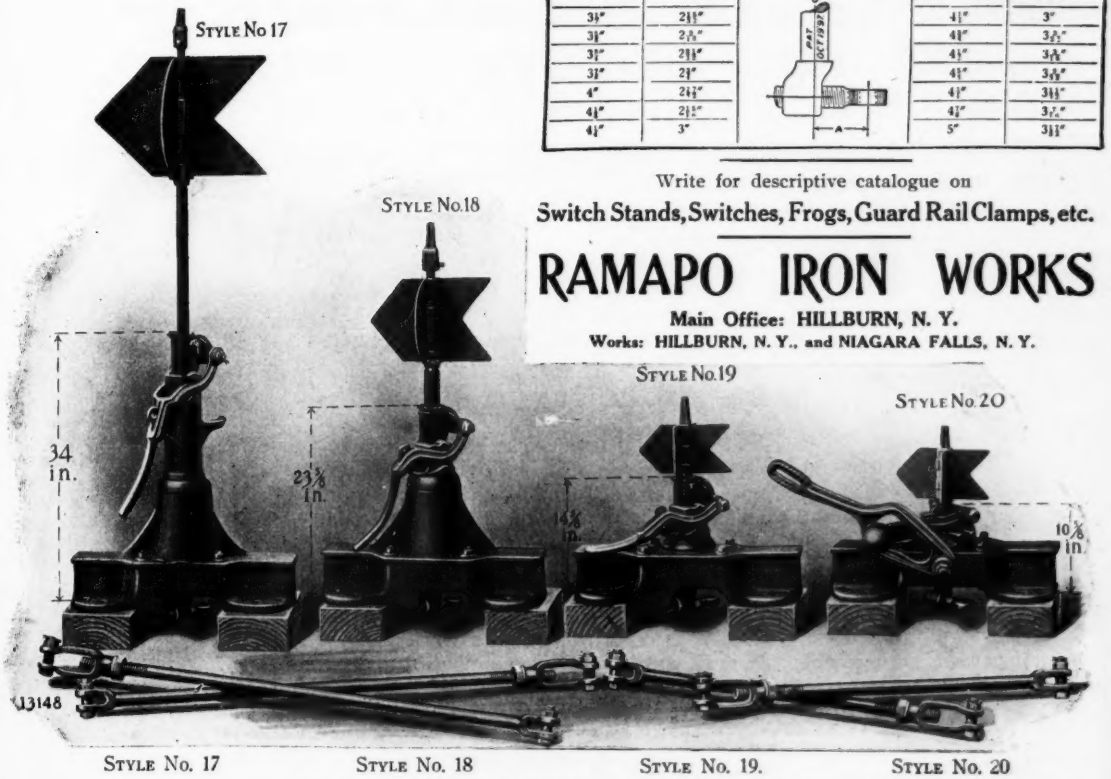
Write for descriptive catalogue on

Switch Stands, Switches, Frogs, Guard Rail Clamps, etc.

RAMAPO IRON WORKS

Main Office: HILLBURN, N. Y.

Works: HILLBURN, N. Y., and NIAGARA FALLS, N. Y.



STYLE No. 17 STYLE No. 18 STYLE No. 19. STYLE No. 20

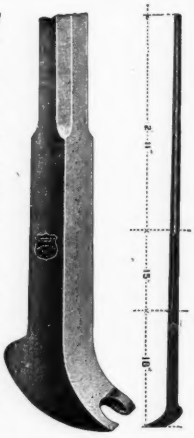
RAMAPO PATENT SAFETY SWITCH STANDS

Double Pointed Railroad Pick

Weight 7 lbs.

HUBBARD

Shovels *and* Track Tools



On what basis do you buy your track shovels? On what basis your locomotive scoops? To the discerning buyer, quality is synonymous with economy. Bear in mind that Hubbard has stood for high standards, efficiency, and real ultimate economy for over a half a century. Specify Hubbard Shovels once—then you will see why leading railroads use Hubbard Shovels. Our new catalog on request.

Every track tool that leaves our plant is guaranteed perfect in workmanship and perfect in material; that's a part of Hubbard Service. Furthermore, if any track tool prove defective in ANY way, prompt replacement will be made *without charge*—another detail of Hubbard Service. Send for prints of Hubbard Track Tools—the prints tell a real story to the mechanical man. This catalog is yours on request.

Square Point Track Shovel

Hubbard & Company

Pittsburgh Pennsylvania

Locomotive Scoop

DO YOU BELIEVE IN SIGNS?
YOU CAN PIN YOUR FAITH TO THESE

AND COMPANY
INGERSOLL-RAND COMPANY
INGERSOLL-
FROGS SWITCHES CROSSOVERS THEY DON'T FAZE THE "IMPERIAL"
"WE NO FHAKA ME SICK IN DA BACK" THAT IS WHAT ONE SECTION MAN SAID OF THE "IMPERIAL" TAMPER
IMPERIAL TIE TAMPING OUTFIT GASOLINE DRIVEN SELF PROPELLED OPERATES FOUR TAMPERS
TWO TAMPERS DO THE WORK OF 15 MEN AND SAVE FIFTY A MILE
HAND TAMPED TRACK IS EITHER GOOD, BAD OR INDIFFERENT "IMPERIAL" TAMPED TRACK IS UNIFORMLY GOOD
ONE ROADS EXPERIENCE WITH IMPERIAL TAMPERS
TRACK TAMPED 14 ¾ MILES
SAVING $2,187.50
TIME 175 DAYS
100% RETURN ON THE INVESTMENT ON EVERY 10 MILE STRETCH OF TRACK TAMPED THE "IMPERIAL" WAY
ALL RAILROADS ENTERING THE NEW YORK METROPOLITAN SECTION NOW USE "IMPERIAL" TIE TAMPERS
ANY KIND OF BALLAST THE "IMPERIAL" DON'T PARTICULAR
TRY YOUR HAND AT TAMPING THE "IMPERIAL" IT'S LIKE CHILDS PLAY

If you did not receive a copy of "Imperial" Tie Tamping Bulletin No. 9023, at the Convention, you should ask us to send you a copy. A postal will bring it.

INGERSOLL-RAND COMPANY

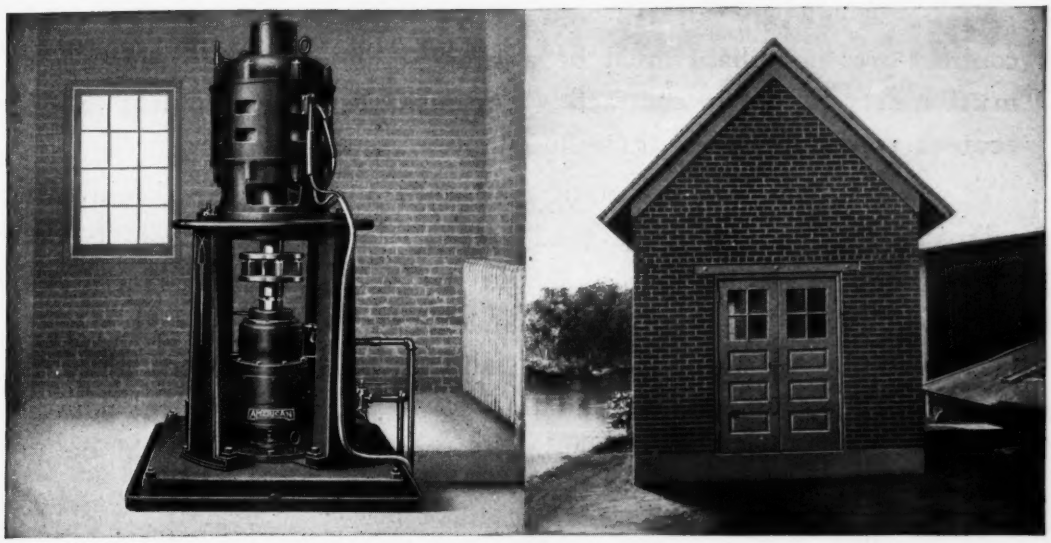
11 Broadway NEW YORK

Offices the World Over

165 Q. Victoria St. LONDON

18TT

AMERICAN



Nearly Double the Quantity of Water With About One-Fourth the Power

The City of Batavia, Illinois, has been pumping water with an Air Lift.

Like most air lift pumping installations, it was very simple in design, but the trouble was, it required an enormous amount of power in its operation.

About a year ago a 12-inch well was drilled a few rods distant from the well in which the air lift was operating, and in the new well an "American" Deep Well Turbine Centrifugal Pump was installed.

Exterior and interior views of the new installation are shown in the above illustrations.

Recently the American Well Works received the following letter from Mr. L. A. Parre, Superintendent of Municipal Plant at Batavia:

Batavia, Ill., Oct. 4th, 1915.

The American Well Works, Aurora, Ill.

Gentlemen: The 12-inch Deep Well Turbine Pump, which we recently purchased from you, is giving excellent service.

With 19 horsepower we are pumping 1143 gallons per minute, from a well 2000 feet deep, against a static head of 40 feet.

Our old well is equipped with an air lift requiring 70 horsepower to deliver 600 gallons per minute with a static head of 40 feet.

The economy of steam and oil consumption is 25% of what was used in the operation of the air lift system.

We would take great pleasure in recommending the American Deep Well Turbine Pump to any person who is in the market for such a pump.

Yours very truly,
(Signed) L. A. Parre,
Superintendent of Municipal Plant.

With 19 horsepower, the City of Batavia is pumping nearly double the quantity of water it formerly obtained using 70 horsepower, and it will be noted that in simplicity of design the new pumping installation compares favorably with the air lift.

American Deep Well Turbine Centrifugals are now saving pumping costs in many waterworks plants.

Catalog 132 describes them. Ask for your copy.

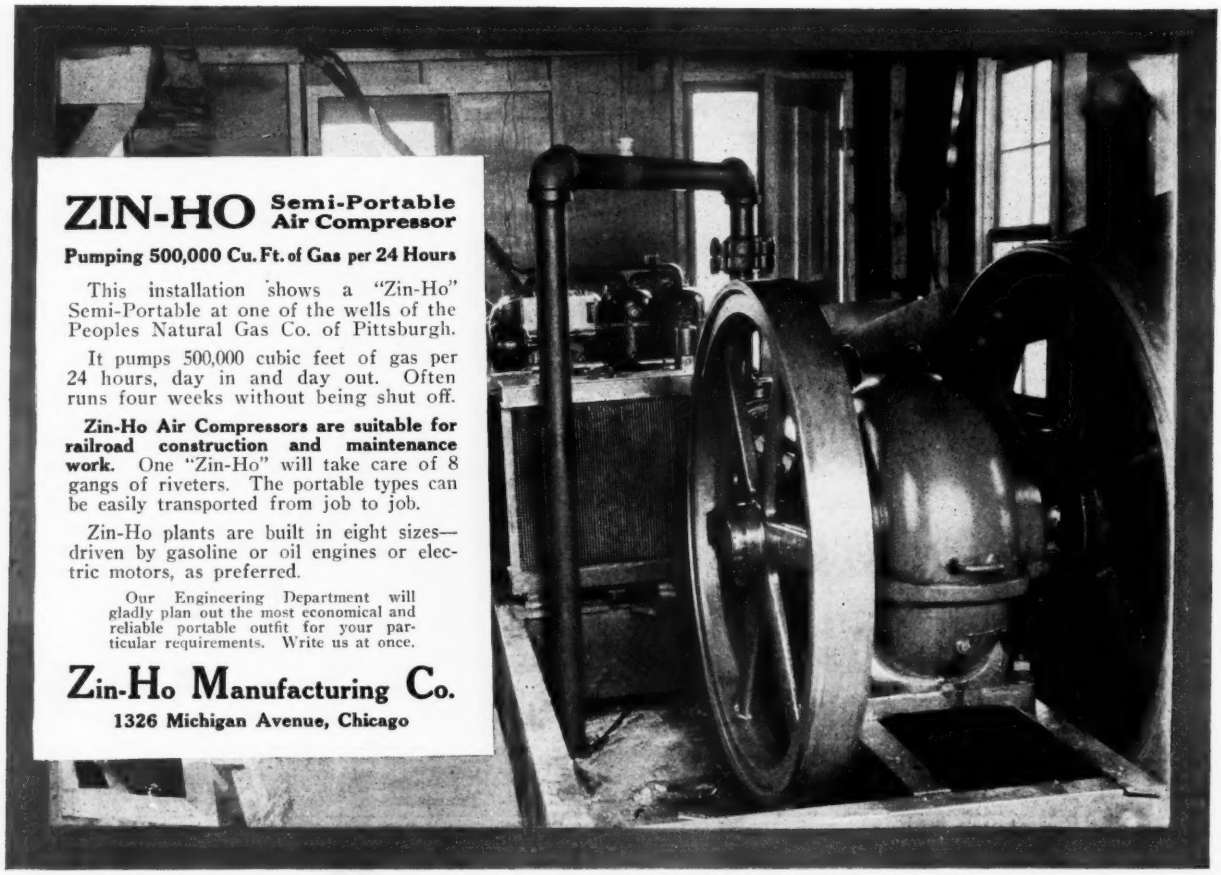
The American Well Works

General Office and Works: Aurora, Ill.
Chicago Office: First National Bank Bldg.

A lawyer will tell you that the four essentials of a valid contract are: first, there must be a subject matter; second, the minds must meet; third, the contracting persons must be competent to execute a contract; fourth, there must be a consideration.

An equally systematic and logical method in examining railroad supplies would give good results. In buying a derail for instance these requirements should be met: first, it should be efficient for derailing; second, it should have few parts and should take care of repeated derailments without being damaged; third, it should be capable of being made a fixed part of the track; fourth it should not weaken the track by its presence; fifth, it should be so designed that one derail may be used with many rail sections.

The Hayes Derail is designed to meet each of these requirements. Nearly 100,000 giving satisfactory service in track prove the thoroughness of manufacture


ZIN-HO Semi-Portable Air Compressor
Pumping 500,000 Cu. Ft. of Gas per 24 Hours
This installation shows a "Zin-Ho" Semi-Portable at one of the wells of the Peoples Natural Gas Co. of Pittsburgh.
It pumps 500,000 cubic feet of gas per 24 hours, day in and day out. Often runs four weeks without being shut off.
Zin-Ho Air Compressors are suitable for railroad construction and maintenance work. One "Zin-Ho" will take care of 8 gangs of riveters. The portable types can be easily transported from job to job.
Zin-Ho plants are built in eight sizes—driven by gasoline or oil engines or electric motors, as preferred.
Our Engineering Department will gladly plan out the most economical and reliable portable outfit for your particular requirements. Write us at once.
Zin-Ho Manufacturing Co.
1326 Michigan Avenue, Chicago

Keppler Roof-lights and Sky-lights

are a marked advance over other forms of roof-light and sky-light construction. Repairs and upkeep are almost eliminated, because of the small, heavy glass units and the method of construction. The important advantages are:

No painting required
Little or no glass breakage
Level top surface
All-glass undersurface
Plenty of daylight
Only cement and thick glass exposed
Fireproof and waterproof
Loads, 40 to 150 lbs. per sq. ft.
Attractive appearance
Easy cleaning
Immediate delivery

These Keppler Constructions are composed of 6 x 6 x1¾ inch glass units, set in steel-reinforced cement-ribs, running in both directions. No special forms or patterns are required; all parts are stock parts and installation can be made immediately for any opening or area.

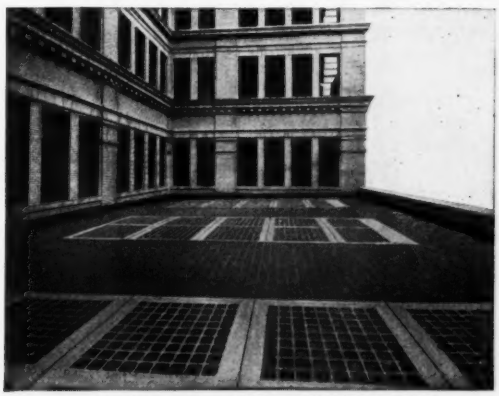
They are the logical construction for railroad stations, warehouses and train sheds, because of little or no maintenance, easy cleaning, fire protection and plenty of daylight.

Their daylighting efficiency and attractive appearance make them especially desirable for banks, hotels, office buildings, fine apartments, and other buildings **where light and appearance are equally important.**

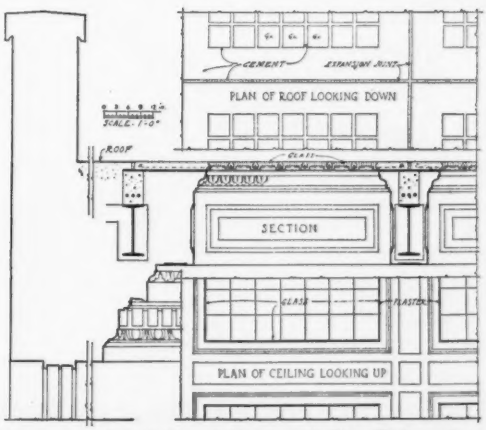
Information

Keppler Bulletins 203 and 205 describe these and other Keppler Constructions for utilizing daylight.

Also, see pages 872-875, Sweet's Catalogue, 1916.



Top View, Chase National Bank, New York



Open court installation of Keppler All-Glass-Undersurface Roof-lights, without underceiling sash — Chase National Bank, New York. Kimball & Roosa, Architects.

Interior, Chase National Bank, New York

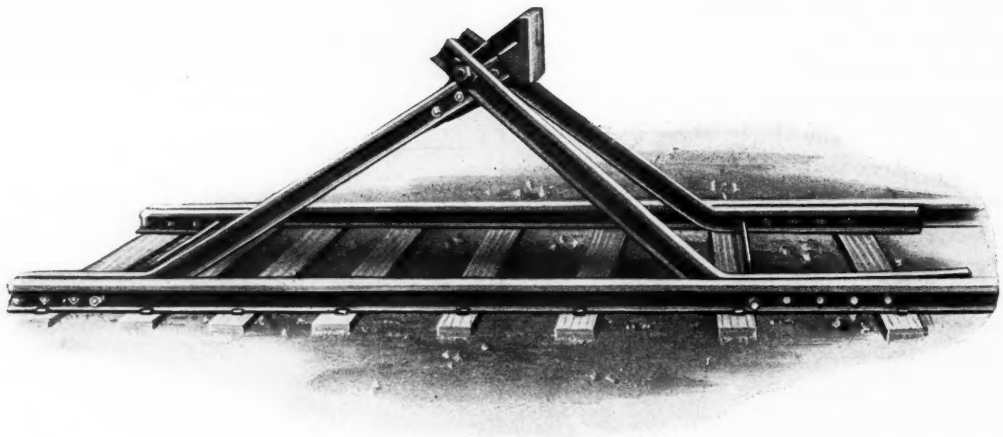
Keppler Glass Constructions Inc Architects Building **New York**

Roofs Sky-lights Train Sheds Floors Vaults Pavements Partitions Fireproof Windows Crystal Ceilings

BUDA ALL STEEL

PATENTED

BUMPING POST



Appearance of Buda All Steel Bumping Post **in a comparative test,** after being hit by a car of coal, total weight 68 tons, at a speed of six miles per hour on a down grade of 3½%, equaling 71,808,000 foot-pounds impact. **No damage done to car,** resiliency of the post acting as a spring buffer.

If you are interested, we should be glad to furnish you full particulars of this test. The only post that was not injured or totally demolished.

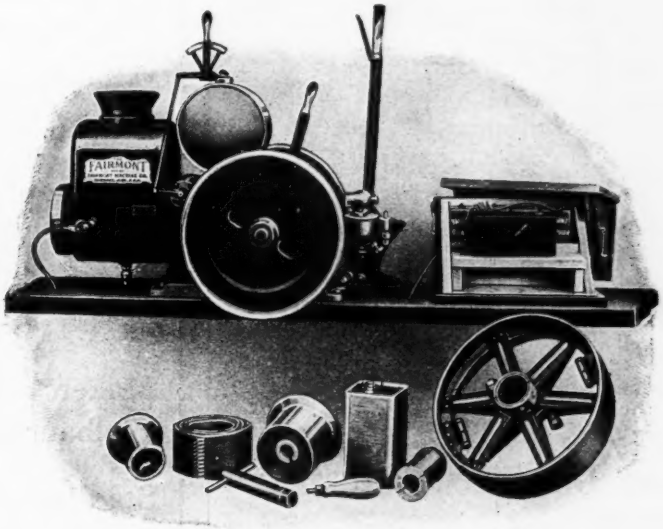
The Buda Company

30 Church St. New York

Railway Exchange Bldg. Chicago

113 No. 2nd St. St. Louis

Every Official Should Read This Letter



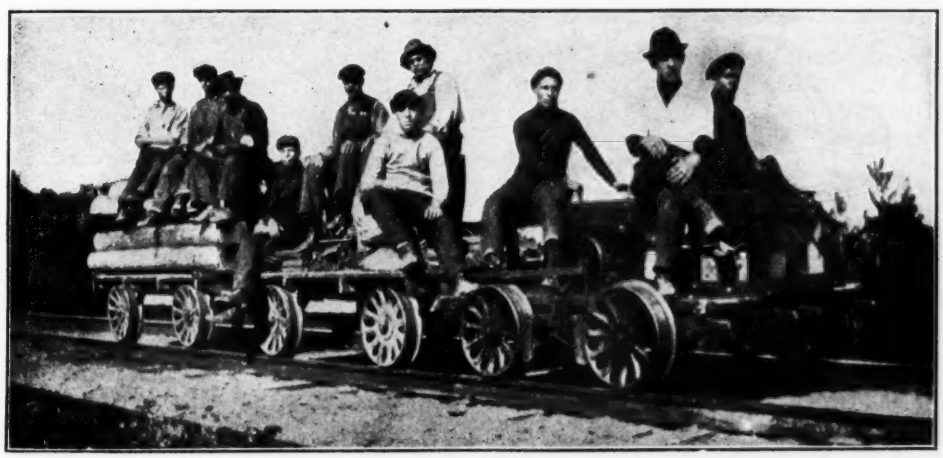
$440 per month saved by Fairmonts

"When I came here in 1912 I had 140 miles of main line and 25 section gangs with foremen at $55 per month. We put Fairmont engines on the handcars, cut out every other section, raised the foremen's pay to $62.50 per month, and have only 15 foremen now.

Made sections 10 miles long, including yards, and after **raising** the pay to $62.50, made a **saving of $440 per month on supervision** and get from one to three hours more labor from the men per day.

The foremen now own their engines. We mount them and furnish all repairs. Have no trouble keeping men.

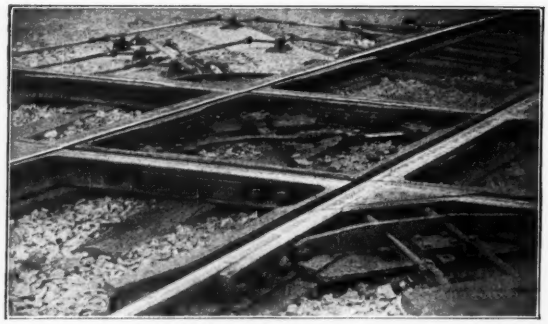
Reduced hand car expense, and our expense to the company has not been over $150 in nearly two years." (Name of Roadmaster on request.



FAIRMONT GAS ENGINE & RAILWAY MOTOR CAR CO.

Formerly Fairmont Machine Company

423 N. Main Street, Fairmont, Minnesota



Eliminate the Pound

The high maintenance cost of railroad crossings is due to the pounding of the wheels in passing over the gap between the rails. By installing the

Eymon Continuous Crossing

You not only eliminate the pound but you save its entire first cost every two years it is in operation.

May we send all the facts?

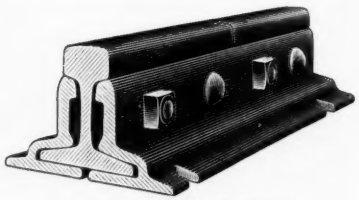
THE EYMON CONTINUOUS CROSSING CO.

MARION, OHIO

The Rail Joint Co.

GENERAL OFFICES:

61 Broadway New York City



Continuous Rail Joint

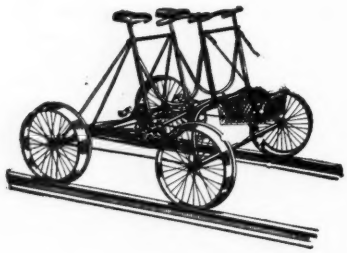
Makers of Continuous, Weber, Wolhaupter and 100% rail joints.

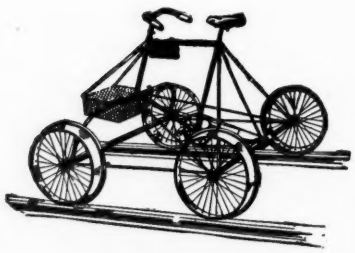
Standard—Insulated—Step—Frog and Switch Types.

Grand Prize San Francisco 1915

Protected by Patents

HARTLEY & TEETER



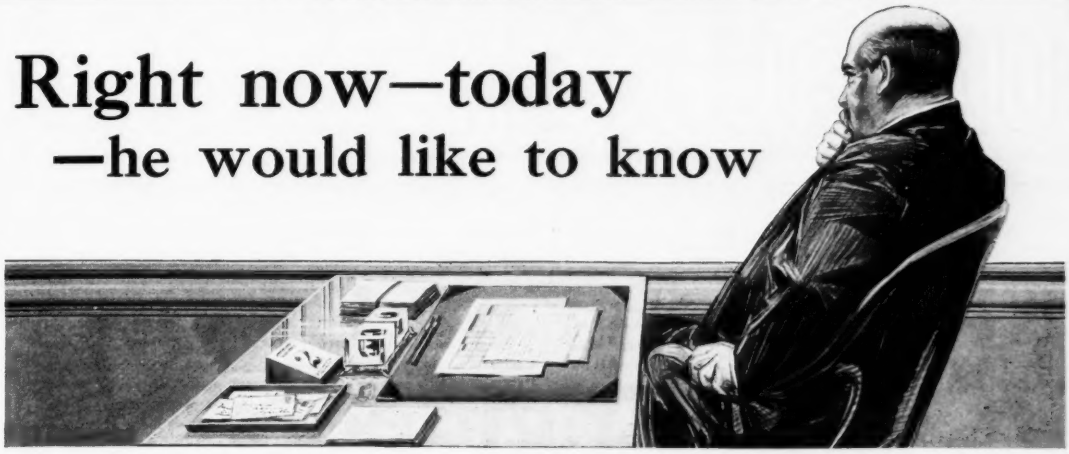


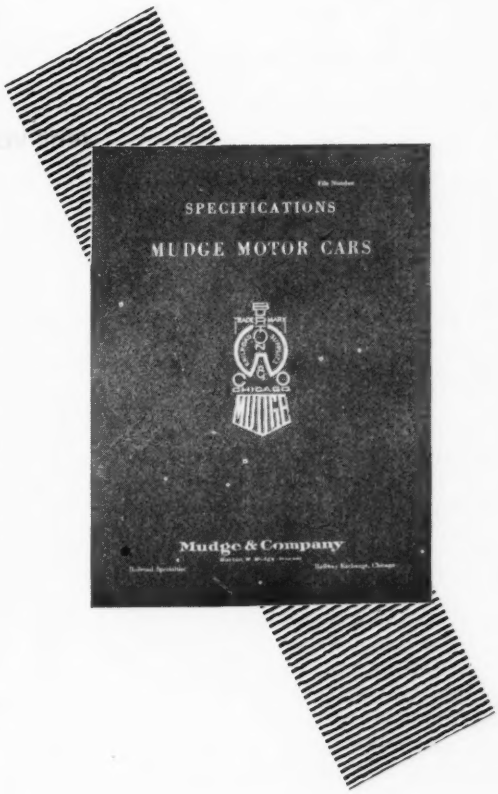
Light Inspection Cars are the Strongest and Lightest running known. The fact that we constantly receive repeat orders is proof absolutely that our cars are giving entire satisfaction. We shall be pleased to supply you with our new catalog that tells all about them.

TEETER-HARTLEY MOTOR CO.

HAGERSTOWN, INDIANA

Right now—today —he would like to know





SOMETHING has just come up that demands the immediate use of a railroad motor car.

It should be selected for service at once.

The car that will best suit the purpose is the first thing to be decided.

In the entire office there is nothing "on file" showing newly designed

MUDGE MOTOR CARS

Is this data now in your office?

If not, several days must be spent in getting together information that *you* can have "on tap" just under your finger tips.

Our complete specifications are put up in a neat folder for mailing and we are glad to send them to you.

Someone in your office can write for a set—today—*if you say the word.*

Mudge & Company

Burton W. Mudge - *President*

RAILROAD SPECIALTIES RAILWAY EXCHANGE

CHICAGO

Bureau of Inspection

"The Eyes of Buyers and Engineers"

Inspection of Maintenance of Way Materials

Rails
Switches, Frogs and Crossings
Bolts and Spikes
Tie Plates
Rail Anchors
Ties
Bridge Timbers and Piles
Relaying Rails
Bridges
Wire Fencing
Reinforcing Steel
Cement

OUR corps of inspectors, maintained at principal manufacturing centers of this country and abroad, are ready to represent you anywhere and everywhere for inspection tests and consultation.

They will follow your orders through every stage of manufacture to delivery.

Our certificate of inspection is an assurance that your specifications have been fulfilled.

Write for booklet containing information for the Maintenance of Way Department.

Robert W. Hunt & Co.

ENGINEERS

BUREAU OF INSPECTION TESTS AND CONSULTATION

2200 Insurance Exchange, CHICAGO 90 West Street, NEW YORK Monongahela Bank Building, PITTSBURGH
Charleston Building, SAN FRANCISCO Syndicate Trust Building, ST. LOUIS

Railway Maintenance Engineer

Volume 12 June, 1916 Number 6

(With which is incorporated the Engineering and Maintenance of Way Edition of the *Railway Age Gazette* and *Railway Engineering and Maintenance of Way.*)

Published during the last week preceding the date of issue by the
SIMMONS-BOARDMAN PUBLISHING CO.,
TRANSPORTATION BUILDING, CHICAGO, ILL.

NEW YORK: WOOLWORTH BLDG. CLEVELAND: CITIZENS' BLDG.
LONDON: QUEEN ANNE'S CHAMBERS, WESTMINSTER.

EDWARD A. SIMMONS, *President.* LUCIUS B. SHERMAN, *Vice-President.*
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ELMER T. HOWSON, *Editor.*
WALTER S. LACHER, *Associate Editor* HAROLD F. LANE, *Associate Editor*

Entered at the Post Office at Chicago, Ill., as mail matter of the second class.

Subscription price, including the twelve regular monthly issues of the *Railway Maintenance Engineer* and the four daily issues of the *Railway Age Gazette,* published in connection with the annual convention of the American Railway Engineering Association: United States, Canada and Mexico, $1.00; foreign countries (excepting daily editions), $2.00.

WE GUARANTEE that of this issue 5,137 copies were printed; that of these 5,137 copies, 4,012 were mailed to regular paid subscribers, 53 were mailed to advertisers, exchanges and correspondents, and 1,072 were provided for new subscribers, copies lost in the mails and office use.

The *Railway Maintenance Engineer* has applied for membership in the Audit Bureau of Circulations.

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Protection Against Accidents

Three passenger trains were derailed recently on important roads because of the weakening of the track at points where the renewal of rails or other repair work was under way. It is to the credit of the maintenance of way department that accidents of this nature are as rare as they are. At the same time, every such occurrence is one too many, and supervisors must be alert to see that safety is placed ahead of every other consideration in the conduct of their work. As it is impossible for them to be on the ground continually where work affecting the safety of trains is in progress, it is necessary that they keep constantly before their foremen the fact that they can afford to take no chances involving the safety of travel. The problem is becoming more serious each year with the increasing necessity of employing inexperienced men in the gangs, and the difficulty of securing an adequate number of competent, experienced foremen to fill vacancies as they occur.

Measuring the Penetration of Preservatives

It has been the universal practice to measure the thoroughness of the treatment of timber in terms of the pounds of oil injected per cubic foot of timber. As pointed out by Lowrie Smith in another column, this may lead to highly inaccurate results with structural timber. As a remedy he suggests measuring the penetration on the basis of the pounds of oil injected per square foot of superficial area. This method has such evident merit that it is surprising that it has not been adopted before, particularly in view of the very general discussion of the penetration necessary for this class of timber. Owing to the variation in the density of timbers and their relative susceptibility to treatment, the amount of oil actually injected will vary with any two sticks of timber. However, it is necessary to select an average figure as a basis for comparison which is sufficiently accurate for practical purposes. As the vital consideration in the treatment is the depth of penetration of the oil from the surface, and as the proposed rule gives this more accurately than the old one, it should meet with ready adoption.

Tendencies Toward Contract Work

The present shortage in the supply of labor for track work is forcing the railways to adopt a number of expedients in order to complete the large amount of work proposed for this season. One method which is being adopted on a number of roads is to contract a considerable amount of maintenance of way work heretofore performed by company forces. In general this is not the result of any decision to adopt this practice permanently, but in many cases it has been resorted to locally to get the task done. It is the natural desire of the roads to conserve the limited amount of labor which they can secure for work on the track, turning over to small contractors that which can be done by other forces. A small contractor possesses a number of inherent advantages over a large railway organization. He can organize his forces directly for the task in hand, pay the wages necessary to secure the desired number of men and vary the wage rate from day to day if necessary to meet fluctuations in the labor market. With a limited number of men under his direction and with the incentive of personal gain resulting from the efficiency of his forces, he will exert closer supervision and secure more work from his

men than the average railway. Several roads have experimented with the contracting of maintenance of way on a large scale. Many railway men believe that a large part of what is now done by company forces will ultimately be turned over to contractors as a practical way of increasing the efficiency of these forces.

THE RECLAMATION OF SCRAP

THE recent statement of a vice-president of an important eastern road that he was not as much interested in the amount of money his road earned as in the amount it saved, deserves special emphasis. Largely as a result of the depression through which the railways were passing until recently, the incentive to economize has been very strong. This has led to the adoption of many methods and practices not emphasized previously. One of the developments to which greatly increased attention has been given is the systematic reclamation of scrap materials. Over $250,000,000 is spent annually for new materials for the maintenance of way department. A considerable part of this amount goes for ties and other materials for which there is little or no salvage value after their serviceable life is exhausted. However, a much larger amount is expended for materials which have a definite and considerable value after their removal from the track and structures. The easiest way to realize on these materials is to sell them as scrap, just as they are received from outlying points. But this is not in most cases the most profitable way, although followed on a large number of roads.

During recent years a number of roads have studied their scrap piles with surprising and highly profitable results. In a number of instances they have found that materials were reaching the scrap dock which were fit for further use and they have adopted measures to prevent such material being sent in. In other instances they have found that with slight expense a considerable portion of the material sent in as unfit for further use could be repaired and returned to service. They have also found that with many tools and built-up materials, parts of worn out units can be used to repair others with economy. Also in the handling of materials properly included as scrap, considerably higher prices have been secured through systematic sorting and preparation to comply with standard market classifications. All these measures and others have resulted in very considerable economies.

The manner of handling maintenance of way scrap varies widely after its collection out on the road and shipment to central points. On many roads the mechanical department has charge of the disposal of all scrap. On others, the maintenance of way department collects and handles its own scrap. On still others, the mechanical department assumes charge of the reclamation of maintenance of way scrap under the direction of employees of the latter department.

The possibilities for economy in the handling of roadway scrap are sufficient to justify a careful investigation of this subject by the maintenance of way department of every line. On those roads on which this subject has been given close attention surprisingly profitable returns have been secured. At the same time the systematic handling of these materials by men familiar with them is far less general than it should be.

In order to stimulate interest in the subject and to present accurate information concerning the results which are possible, we announce a contest on The Reclamation of Maintenance of Way Materials. This contest will include discussions of the manner of handling, sorting and disposing of scrap materials, the keeping of usable materials out of the scrap pile and the reclamation of materials for further service, either directly or through repairs, and the extent to which such repairs are justifiable. In addition to a discussion of this subject, special attention will be given to papers describing methods actually in force and the results secured, with detailed descriptions, and cost figures showing the expense of conducting this work, and the savings resulting. Photographs will also be valuable. We will pay $25 and $15 for the two best papers received in this contest, and our regular space rates for all others accepted and published. All contributions should be sent to the editor of the Railway Maintenance Engineer, Transportation Building, Chicago, and must reach him not later than July 15, to be considered by the judges.

STUDIES IN ORGANIZATION

CONDITIONS in the maintenance of way department are changing rapidly. Traffic has increased continuously, wheel loads are heavier and the service demanded of the track and structures has become increasingly severe. At the same time higher and more exacting standards of maintenance are required than ever before. With these conditions on the one hand the railways have been confronted on the other with a changing and rapidly deteriorating supply of unskilled labor, and with new problems in the use of materials, following the transition from Bessemer to open hearth steel rails, from hard wood ties to those of softer and less durable timber, etc., all of which have tended to increase the cost of maintenance of way work.

These conflicting conditions of more exacting service and the rising cost of labor and materials require increased supervision and the concentration of trained men on the solution of these problems from day to day. Good track and uniformly high standards of maintenance alone are not positive proofs of the highest degree of efficiency, for some roads are spending more than is necessary to secure these standards. Rather, efficiency in maintenance of way operations should be measured by the standards of maintenance secured per unit of expenditure, local conditions considered. A number of roads have realized the necessity for close supervision of this work and have placed it under the direct charge of men qualified by training and practical experience to direct it and devote their entire time to it. Other roads have not given the subject the attention thus far which the large expenditures warrant and as a consequence they are not, in many instances, securing the best results possible.

This condition has led to the preparation of a series of articles describing the organization of the maintenance of way department as it has been developed on a number of roads which have given this subject special attention. In some instances this organization is strictly divisional in character, in others departmental and in still others a combination of the two. In addition to discussing the form of organization, the articles will also describe methods which are being followed on these roads to effect economies in so far as they are not commonly adopted. The first article in this series describes the organization of the maintenance of way department of the Lehigh Valley and a number of the methods which have been developed on that road.

The days when the "old man ran the road" are gone. This is the age of specialization in all industries and in all branches of railway service as well. The universal realization of this fact will mean much for the maintenance of way department and for the efficiency with which its work is handled, for once it is recognized and

the necessary measures taken, improvements in other conditions will come as a matter of course.

THE RAILWAY MAINTENANCE ENGINEER

WITH this issue the Railway Maintenance Engineer makes its initial appearance. It is not, however, a stranger to the maintenance of way field, for it has been formed by a consolidation of the Maintenance of Way section of the *Railway Age Gazette*, which has appeared regularly in the third issue of each month of that paper for the past five years, and of Railway Engineering and Maintenance of Way, which we have acquired, and with which was consolidated the Roadmaster and Foreman about five years ago. While the weekly issues of the *Railway Age Gazette* will continue to present information concerning maintenance of way problems of interest to railway men in all departments and will aim to give them the data which they as broad railway men will require, the Railway Maintenance Engineer will devote its entire attention to the problems of this department and will present information of interest and value to those engaged in the upkeep and improvement of the track, structures and other fixed physical properties.

More attention is being paid to maintenance of way work to-day than ever before and the progress being made in the development of materials and methods is correspondingly rapid. More exact and scientific methods are being demanded under the necessity of securing the maximum return for every dollar expended. Rapidly changing conditions with respect to labor and materials and the increasing severity of the demands made on the track and structures combine to present new problems which must be solved. No one group of men can work out these problems unaided. The greatest progress can only be made through the co-operation of a large number of men and the free exchange of information and ideas. It will be the aim of the Railway Maintenance Engineer to assist in the dissemination of this information which will aid in the conduct of the work in this department. Descriptions of new methods and materials will be presented from month to month for the information of the more experienced as well as the education of the younger men in the field. Particular attention will be devoted to the presentation of information which will assist employees of the maintenance of way department, whether chief engineers or section foremen, to handle their work more economically and efficiently.

Special attention will also be given to the development of a comprehensive news department, in which will be chronicled changes, promotions and transfers among railway and supply men in this field, improvement and construction work authorized, etc. We solicit for the Railway Maintenance Engineer the co-operation of men interested in this department of railway activity in advising us of new developments, changes in personnel, and other information which will be of interest to our readers, in order that the Railway Maintenance Engineer may be made thoroughly representative of the activities in the maintenance of way field, and be of the greatest value to our readers and to the railways who employ them.

PRESSURE OF WET CONCRETE.—Further tests on the lateral pressure of concrete on forms were made recently at the University of Illinois, both in the laboratory and on actual construction. These tests tend to confirm earlier ones. The pressure corresponds to the hydrostatic pressure of wet concrete until the concrete has partly set. It is also influenced by the rate of pouring.

LETTERS TO THE EDITOR

EXPERIENCED FOREMEN WANTED

WELLINGTON, ILL.

TO THE EDITOR:

A trackman's work is skilled labor; untrained men are useless and do inferior work. We must have trained and practical trackmen for leaders whose work is the result of years of experience. There is an army of 45,000 foremen and 340,000 trackmen in the United States, and yet we need all the trained men we can get, for only well-trained men can do first-class track work. One trained man is worth three untrained. I believe experience should be made a condition of promotion for foremen. It is not what one does, but how one does it that is the test of capacity. Nothing is so costly as ignorance. The best railroad requires constant supervision, skillfully planned to keep the track in good order. The foreman should know from actual inspection that the track is in order so that nothing likely to cause accidents or delay may occur. The responsibility for safe track is in the hands of the foreman, and his pay should be good. There should be two trained men in each gang, the foreman and an assistant.

JOHN MITCHELL.

TIGHTENING TRACK BOLTS

ST. BERNARD, O.

TO THE EDITOR:

The article by Earl Stimson, published on page 317 in the issue of the *Railway Age Gazette* of February 18, relative to track bolts and track wrenches contained much useful information, but I believe that the idea of track bolts being stretched until they give poor service, as well as the idea of the proper length of track wrench to be used as expressed in this article, are wrong. Evidently the testing machine which was used or some of the figures which were secured have misled the author, for he claims that the average track laborer is liable to overdraw a 1-in. bolt with a wrench 42 in. long.

If this is tried in the track instead of on paper and a testing machine it will be found that a man cannot tighten a new well-oiled 1-in. bolt enough to cause it to stretch under heavy wheel loads, with a wrench 54 in. long. New, well-oiled 1-in. bolts can be tightened with a wrench 42 in. long or even 36 in. long, provided the nuts do not fit very tight, but among old bolts that are somewhat rusty many will be found that cannot be properly tightened with a wrench of that length even after they have been oiled. As long as the old bolts taken out of the track do not show any indication of having been stretched there is no need of one becoming alarmed and cutting the wrenches so short that they cannot be tightened properly. The poor service that track bolts are giving is not due to their being overdrawn and stretched, but because they are not kept tightened properly. The use of shorter wrenches will surely increase rather than remedy this trouble.

The loosening of the bolts is not caused by the nuts coming off, as is often believed, but it is due to the friction caused by the expansion and contraction of the rail and the vibration of passing trains, which causes the rail splices to work deeper into the rail, leaving the bolts loose. Other trouble results from the fact that two or three bolts will break at a joint and the rail run apart, leaving the joint open. For this the bolts are not to be

blamed, as it usually is the running of the rail that cuts them off. Sometimes a bolt will break of its own accord, but this is very rare. The threads are stripped off a bolt or nut only where the nut does not fit properly, or where the bolt is so short that the nut will go on only a few threads. Nuts come off only where they fit too loosely. Another trouble with track bolts and one that seems to be much misunderstood, is that many break when they are tightened after being in service a few years. This is because of the fact that the nuts fit tight on the bolts and when they become rusted the bolts will break rather than tighten. On a number of railroads where this breakage was noticed it was believed to be due to trackmen overdrawing the bolts so that they broke and the wrenches were shortened so that they could not be broken. While this was effective in stopping the breaking of bolts it made it impossible to tighten a large percentage of the loose bolts. As a result bolts were often neglected or instructions were disregarded and an extension put on the wrenches. In this case the proper remedy is to oil the bolts a few days before tightening them and then to turn the nut backwards a little before tightening it, rather than in cutting the wrenches so short that the bolts cannot be tightened properly.

E. F. PETRY,
Track Foreman, Baltimore & Ohio South Western.

EIGHT-HOUR DAY ON CONSTRUCTION WORK

CHICAGO, ILL.

TO THE EDITOR:

If the so-called eight-hour day, for which the railway orders are contending, becomes effective, it will have a marked effect on the cost of work-train service on construction and maintenance work, and engineers who are engaged in this class of work will no doubt be interested in knowing what this will mean in dollars.

PRESENT SCHEDULE—10 HOURS' PAY FOR 8 HOURS' WORK, 1½ TIME AFTER 8 HOURS

	Present Wages				Proposed Wages				
	For 10 Hours	Average Day 13 Hours	Average Month 28 Days	Per Hour	For 8 Hours	Average Day 13 Hours	Average Month 28 Days	Increase Per Month	Per Cent of Increase
Engineer	$ 5.20	$ 6.76	$189.28	$0.65	$ 5.20	$10.07	$281.96	$ 92.68	48.96
Fireman	3.25	4.225	118.30	.40625	3.25	6.30	176.40	58.10	49.11
Conductor	4.18	5.434	152.15	.5225	4.18	8.10	226.80	74.65	49.06
Brakeman	2.78	3.614	101.19	.3475	2.78	5.386	150.81	49.62	49.03
Brakeman	2.78	3.614	101.19	.3475	2.78	5.386	150.81	49.62	49.03
Entire Crew	$18.19	$23.647	$662.11	$2.27375	$18.19	$35.242	$986.78	$324.67	49.04

When bridge and track crews work 10 hours per day it has been found that it is necessary for the work-train crews to work about 13 hours per day. This is one class of train service where it will not be possible to reduce the time to an actual eight-hour day. It is necessary for work trains to tie up at some point where coal and water are available, and as this often means a run of 25 to 50 miles, night and morning, it is necessary for the train crew to put in two to four hours more per day than the bridge or track crews they serve.

To show what the increase would mean in dollars, I show here the present rates of pay on one of the roads in the middle West, and also the rates that would have to be paid under the demand for ten hours' pay for eight hours' work, with time and one-half pay for overtime.

It will be noted that at the new rate the engineer would receive $281.96 per month, or $3,383.52 per year if he worked the entire time, but as the construction season lasts only about seven months it would probably be necessary for him to go back to firing. He would then receive only $150 to $175 per month, according to the amount of overtime he succeeded in getting in, or if he did not spend too much on picture shows, etc., during the summer he would, very likely, have enough left of the $1,973.72 he had received for his seven months' work so that he could take a short vacation.

In nearly all classes of railway construction work, the cost of work-train service is an important item of expense, and in some classes of work, such as driving piles on the main line, and spotting cars in a gravel pit, the wages of the trainmen and enginemen constitute about 25 per cent of the cost. This is also an important item in the expense of unloading ballast and track material, unloading concrete bridge and culvert material, and handling steel erection derricks.

To anyone familiar with railway construction work the attitude of the men as to a real eight-hour day is well known. The work is easy, the hours regular and the men are out for the money.

I recall the complaints that arose and the threats to quit the work-train service, where men held rights for regular trains, when an order limiting work trains to 12 hours per day was proposed.

Is the increase demanded by the train service men justifiable as compared with the salaries paid to other classes of railway employees? On the construction work mentioned above, under the present schedule, the locomotive engineer receives more per month than the assistant engineer in charge of grading and bridge work on 50 to 80 miles of line, or the roadmaster in charge of the track-laying and ballasting. The conductor receives more per month than the resident engineer in charge of 10 to 15 miles of construction, and the fireman and the brakemen each receive more per month than the instrumentmen, inspectors or draftsmen.

The cost of living has increased alike for the organized and the unorganized employees of the railways, while the increase in compensation has been more favorable to organized labor, and I think there is a feeling among the unorganized forces that every increase granted to organized labor makes it harder for other employees to secure merited advances in wages. I recall a case of a locomotive engineer being appointed trainmaster, who, after a six-month trial, went back to his engine, saying, "there was too much grief for the money with no limit to the hours and no overtime for a trainmaster."

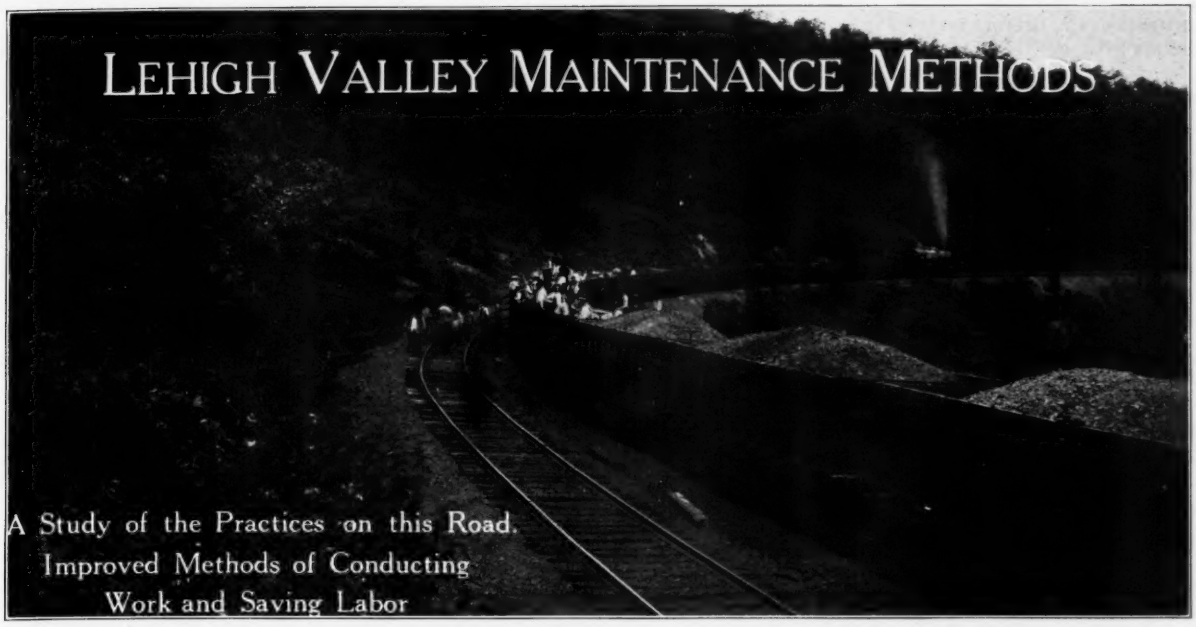
CONSTRUCTION ENGINEER.

NEW BOOKS

The Practical Design of Steel Framed Sheds. By Albert S. Spencer. 157 pages, 6 in. by 9 in. Bound in cloth. Illustrated. Published by D. Van Nostrand Company, New York. Price $3.50.

This book is very largely a compilation of tables of complete designs for the roof trusses and columns of frame shed buildings of 40 to 100 ft. spans. The methods used in arriving at these designs are given in detail, together with 12 plates showing graphic methods. The last two chapters in the book are devoted to external coverings, gutters, pipes, ventilation, etc. While entirely general as to theory, the treatment is essentially English as to practice and in scope is limited to a single type of structure, namely, a plain rectangular building with a flat gable roof.

LEHIGH VALLEY MAINTENANCE METHODS



A Study of the Practices on this Road. Improved Methods of Conducting Work and Saving Labor

Unloading 199 Cars of Cinders with One Train in One Day

THE Lehigh Valley has made marked progress in the development of efficient methods in the maintenance of way department during the past few years. The standards to which the property has been maintained have been raised materially while the expenditures for upkeep have been moderate. This has been made possible primarily by the close attention given to the details of this work by trained men devoting their entire time to the work of this department. Because of the concentrated attention given to the work of this department this road has been a pioneer in a number of practices leading to important economies, which are attracting much attention from railway men throughout the country to-day. It is the purpose of this article to discuss the organization which has been developed on this road and to point out some of these methods not commonly known or followed.

The Lehigh Valley comprises 1,442 miles of road, about half of which is classified as branch lines. The main line extends from Jersey City to Buffalo and Suspension Bridge, with a number of branches in the anthracite coal fields near Wilkes-Barre and Hazleton, Pa., and in the lake region of western New York. Including the main line a total of 595 miles has two or more tracks. The revenue freight traffic density for the fiscal year ending June 30, 1915, was 3,689,820 ton miles per mile of road and the passenger density 149,403 passenger miles per mile of road. Slightly over one-half the freight traffic consists of coal, moving in heavy trains eastward from Wilkes-Barre and Hazleton coal regions to tidewater and also westward to the great lakes. For operating purposes the road is divided into seven divisions.

The Form of Organization

The organization of the maintenance of way department of the Lehigh Valley is strictly divisional in character. The engineer maintenance of way, with office at the operating headquarters at South Bethlehem, Pa., is in charge of all work in this department, reporting to the general manager. All engineering work incident to maintenance operations is handled through this office as is all construction work carried on with company forces. The road owns two steam shovels, 100 air dump cars and other auxiliary equipment in addition to two ditchers, 35 locomotive cranes, etc. The construction equipment is employed to a large extent in doing small grading work for side track extension and minor track changes. It is also the practice of this company to build some of the smaller stations and other buildings with company forces.

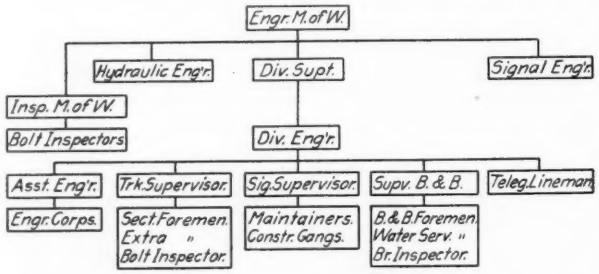
All construction work for new lines, large structures and important improvements is handled by an entirely separate organization under the direction of the chief engineer located at the executive headquarters at New York and reporting to the operating vice-president. All work done by contract is likewise handled through this same office.

The engineer maintenance of way has a staff of assistants, including an inspector maintenance of way, a hydraulic engineer and a signal engineer. The inspector maintenance of way gives special attention to the details of track work. The hydraulic engineer has charge of water service and of the operation of all water stations, while the signal engineer is responsible for the construction and maintenance of signals and other work commonly incident to that position.

The engineer maintenance of way and his staff handle all matters with subordinate officers through the regular division organization. Each division has a division engineer in charge of maintenance of way matters reporting to the division superintendent, and he in turn reports to the engineer maintenance of way on such work. Each division engineer in turn has a complete maintenance of way organization with assistant engineers, supervisors of track, bridges and buildings, and signals. A telegraph lineman is also assigned to each division reporting to the division engineer and handling local repair work. Telegraph line work of any magnitude is handled by floating gangs reporting to the superintendent of telegraph, who, in turn reports direct to the general manager. Water service work on the division is under the charge of the supervisor of bridges and buildings. Each signal supervisor has the usual corps of maintainers with their assistants and also has a construction gang for the heavier work on the division. Each division engineer also has a small engineering corps, which does all the survey work

incident to the routine maintenance of way problems. In the maintenance of bond wires and insulated joints there is a close relationship between the forces of the supervisors of track and of signals, the section forces being required to maintain these bond wires and joints while the signal maintainers are required to inspect them, and both forces are held responsible for failures.

The division engineers are promoted from the assistant engineers in the maintenance of way corps or from



ORGANIZATION CHART OF THE MAINTENANCE OF WAY DEPARTMENT

supervisors; the supervisors come from the ranks of the foremen and the engineering corps. On the busy main-line divisions a supervisor's territory covers about 50 miles of line.

The standard sections of rail used on main line are the A. R. A. type A 100-lb., and the Lehigh Valley 110-lb. sections, the latter having practically the same dimensions as the 100-lb. rail except that more metal is added in the head. The 110-lb. section was designed primarily for use on those divisions of heavy curvature. This road is now laying 2,500 tons of 136-lb. rail. A straight angle bar is used with the 100-lb. and 136-lb. rail, and one with a reinforced head on the outside with the 110-lb. rail. Approximately 85 per cent of the ties used are creosoted. Between 15 and 20 per cent are secured locally along the line. Twenty ties are laid per 33-ft. panel. All ties on curves and all treated ties on tangents are tie plated.

No. 15 turnouts, with 21-ft. switches, are standard on main line except for high-speed movements where No. 20 frogs, with 30-ft. switches are employed. Manganese frogs and crossings are used exclusively on main lines and on busy switching leads in yards. On lighter traffic tracks, open hearth frogs are used, while many frogs removed from main tracks because of wear are also relaid in these yard tracks.

SECTION WORK

In any maintenance of way organization the majority of the employees are in the section gangs and much of the success of the department depends on the efficiency of these men. In common with other eastern roads the Lehigh Valley has a large number of foreign section foremen, mainly Italians, and the laborers are to a very large extent foreign. About 40 per cent of the track laborers are employed throughout the year. Practically all of these are in the regular section gangs, although a few men in extra gangs remain in their cars on the line during the winter to assist in the renewal of rail. However, in most instances, rail is removed with forces organized by combining several regular winter section gangs.

Special attention is given to the problem of making the surroundings attractive for the men as a means of holding them in the service. At a number of places new and modern section houses have been built for the foremen and also for the men in the gang. The laborers are also encouraged to start gardens on unoccupied land on the right of way which the company gives them the use of. In a number of instances measures such as these have been found to hold the men on the Lehigh Valley when higher wages have been paid on neighboring lines.

The average length of section on double track is 4 miles and on four-track lines 3 miles. The normal summer section force is 7 men and the winter force 3 men, the gangs being increased as local conditions demand.

One of the most important innovations which have been introduced has been the reorganization of the program of section work whereby one-third of each section is overhauled thoroughly each season, so that it will require the minimum amount of attention during the intervening two years. When overhauling the track in this way, the old ballast is cleaned to the bottom of the ties and extensive tie renewals are made while the track is given a light raise, sufficient to give the ties a new bearing and filled in and dressed with new ballast. The work is done thoroughly and carefully, so that the track will require only the routine attention for some time. By going over a portion of each section each year in this way, it is possible to maintain the ballast and the ties in good condition without disturbing the entire track each year as is customary when the ties are "spotted in" indiscriminately and light surfacing done here and there over the entire section. In renewing switch ties on main lines "spotting in" is likewise discouraged and they are renewed only in entire sets. Any ties removed which are good for further service are then relaid in yard turnouts.

To handle the work in this manner the section gangs are assisted by extra gangs, whose duty it is to raise the track for the section gangs while leaving the final surfacing for the permanent forces. An extra gang raises enough track on each of several sections to keep the regular gangs busy with the surfacing for four or five days. They are provided with motor cars, and after raising the desired amount of track on one section they go to the next. Their work is so arranged that by the time the section gangs catch up with them, the extra gangs have covered all the sections on which they are co-operating in this manner. They then return to the first section and repeat the performance. In this way they expedite the work of the section gangs materially while leaving to them the more accurate and careful finishing details and placing the responsibility for thorough work on the forces who will have to maintain the track in the future. As the formation of large gangs is discouraged, these extra

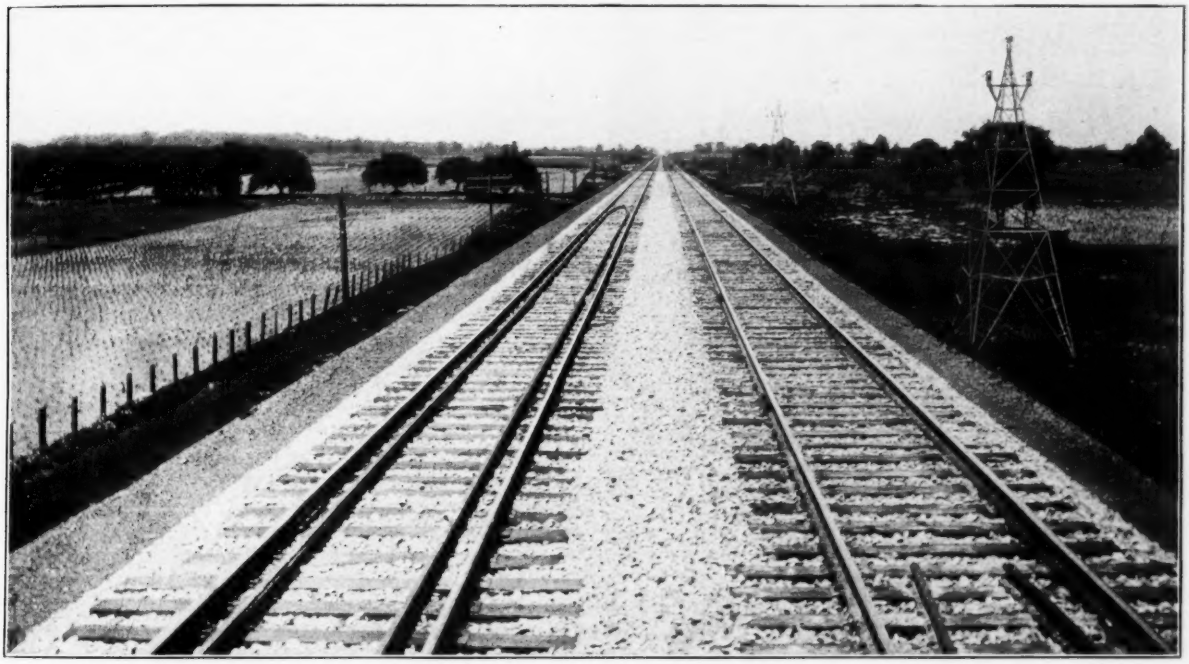
LAYING RAILS WITH A LOCOMOTIVE CRANE

gangs are limited to about 15 men. When on a section they are not consolidated with the regular gangs, but work separately, preserving the identity of each force.

As fast as practicable, hand cars are being replaced with motor cars for section gangs. No more hand cars are being purchased, but as fast as new cars are required the section and extra gangs are being supplied with motor cars on main and branch lines alike. There are 289 sections on the Lehigh Valley. At the present time the road owns 182 motor cars.

In spite of the fact that a large mileage of the line is very crooked, and it is impossible for trains to be seen any considerable distance in many places, it has been found that the number of accidents has not increased, but, if anything, has decreased, following the installation of motor cars. This is accounted for in large measure by the fact that the men have learned to take advantage of the normal danger automatic signals, which give them an advance indication of trains coming up behind them.

When the motor cars were first installed, a system inspector was employed to keep them in repair. Now an experienced mechanic on each division travels over the division inspecting the cars, adjusting them and making minor repairs on the ground. The cars are sent to the local division shops for heavy repairs, which are made by this same man. With this system it is seldom that over two or three cars are out of service on the entire line at a time.



A SECTION OF TRACK WITH SHOULDERS WIDENED WITH CINDERS

LAYING RAIL WITHOUT SPACING JOINT TIES

Another practice in which the Lehigh Valley has been a pioneer is that of laying rail without spacing ties. After careful consideration the officers of the road came to the conclusion that the uniform spacing of ties throughout the rail length was more important than the arbitrary spacing at the joints to conform to some standards, resulting in many instances in throwing the joint ties onto a new bed. As a result the respacing of the ties when they are otherwise evenly distributed was discontinued in 1910 except where changing to a standard of 20 ties per panel.

As a logical result of this step it was decided to lay the rail during the winter when the interference with other maintenance operation was less and labor conditions are more satisfactory. During the last six years practically all rail has been laid during the winter without spacing joint ties. In this period a total of 179,300 tons or 1,125 track miles of new 90-lb., 100-lb. and 110-lb. rail has been placed in track in this manner, in addition to 129,700 tons or 1,037 track miles of rail relaid in secondary or branch lines. The results of this practice have been observed very closely and although rail laid in this manner has been in service for varying periods up to six years, no detrimental effect has been observed.

Rail anchors are applied to the new rail on the same day that it is laid, their application being a part of the rail renewal. These anchors are applied in sufficient number to hold the rail from creeping as conditions require. No attempt is made to prevent creeping through spiking the slots in joints.

In addition to permitting this work to be carried on during an otherwise dull season, an immediate saving of over $350 per mile has been made, by eliminating the spacing of ties and the later surfacing which would be necessary because of the shifting of the joint ties onto new beds. The forces employed in laying the rail at this season consist mainly of section gangs combined for this work. In this way productive work is secured during a season when a certain force is required for emergencies, but is not otherwise employed on constructive work at all times. By employing the men in this way greater value is secured for the money expended for this labor.

At the time the advisability of eliminating the respacing of joint ties was under consideration the causes of the deterioration of rails were studied carefully and the conclusion was reached that the primary conditions leading to battered rails were loose bolts and excessive expansion. As a result a system was inaugurated to insure

the maintenance of tight bolts. A bolt inspector was employed, reporting direct to the office of the engineer maintenance of way to devote his entire time to checking the number of loose bolts found on the different sections over the system. Working under instructions from the general office this inspector goes from place to place tapping every bolt in a mile or in multiples of a mile, and recording the number of loose, slightly loose and missing

A MACADAM HIGHWAY CROSSING

bolts per mile of track. He also notes and reports any rail anchors loose or missing. This man reports directly to the engineer maintenance of way on each mile of track checked and copies of this report are forwarded by the engineer maintenance of way through the division superintendent to the division engineer and supervisor. After a short interval this inspector again goes over the same territory and makes another check. If any unsatisfactory conditions reported on the first inspection have not been remedied, disciplinary measures are applied.

To insure that the foremen are giving this subject the proper attention, each supervisor has a bolt inspector, who devotes the larger part of his time to the same work. As a result of this campaign, which started six years ago, it is seldom that over 25 or 30 loose bolts per mile of track are now found as compared with 900 to 1,000 frequently reported when the campaign was first inaugurated.

Track bolts are also oiled twice each year by the track walker alone or assisted by the regular section forces. Two or three weeks before rail is to be relaid, the bolts are again oiled to permit them to be removed readily. As a result of this practice it is necessary to cut very few bolts and at least 95 per cent of those removed are forwarded with the rail for re-use.

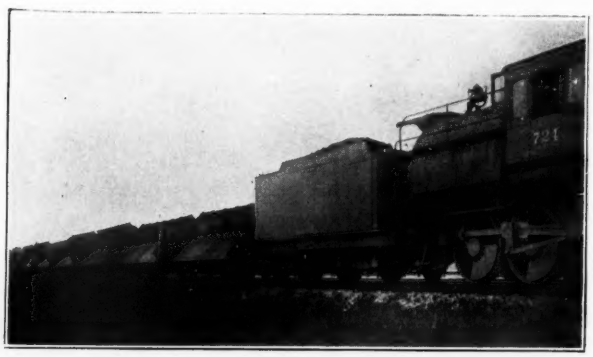
LABOR-SAVING EQUIPMENT

Special attention has been given to the use of machanical equipment to replace manual labor for much of the heavier work. The Lehigh Valley owns 35 locomotive cranes in addition to 8 light steam derricks and two double-end and two single-end, air-operated hoists. Fourteen of these locomotive cranes, the steam derricks and all of the air hoists are regularly assigned to the maintenance of way department and are distributed on the different divisions. In handling large jobs, requiring several cranes, it is also possible to secure temporarily those assigned to ash pits, coaling stations, etc.

For the past six years the loading and unloading of rail by manual labor has been entirely eliminated and power equipment employed. Frequently, where a large amount of material is to be distributed or picked up, several cranes or derricks are placed in one train. Thus one work train with 9 loading machines, each provided with an operator, a fireman and four laborers, loaded 115,817 lineal ft. of 90-lb. rail or nearly 11 track miles on the main line of the Wyoming division between 6:30 a. m. and 3:55 p. m., April 5, 1915. These rails were numbered and loaded in proper order in 37 cars, so that they could be unloaded and relaid in the same order in which they came out of the track. This record was made without interruption to trains on this heavy traffic main line.

In June, 1915, one work train, with several machines, loaded 149,466 lineal ft. of 90-lb. rail with fastenings, or 14.15 track miles, on the Seneca division, in one day. This comprised 2,002 tons of rails and was loaded at a cost of 15.6 cents per ton. Similar records have been made in unloading rail, one work train with seven machines distributing 85,494 lineal ft. of 100-lb. rail in one day.

During the past year locomotive cranes have been employed very successfully in place of tong men to place the rail in position in the track in relaying operations. In this work it has been found that a foremen with six men, a locomotive crane and an operator is able to throw out the old and lay the new rail much faster than men could do it. In addition all the heavy lifting is eliminated in this way. On July 12, 1915, 4.07 track miles of 100-lb. rail, including four turnouts, was relaid in the main line between Gilbert, N. Y., and Lodi, and all the released material was picked up, the new material being distributed beforehand. Four locomotive cranes and crews were employed, two starting at each end and one relaying each rail. The first crane started work at 6:23 a. m., and the last rail was in place at 12:51 noon. The cranes then turned back and assisted the air loaders to pick up the material released, the last of which was loaded in proper order for shipment at 6:30 p. m. Including all delays, the four cranes laid an average of 64 rails each per hour for the entire period they were working. As a result of these trials it is now the standard practice to organize so as to unload the rails and fastenings ahead of the cranes the day they are relaid, in this way reducing the interference with traffic still further and concentrating all the work in one day. While this requires special organization beforehand and the assembling of a relatively large force for one or two days, it is possible in



UNLOADING CINDERS FROM DUMP CARS

this way to select those days on which the traffic is lightest and the resulting interference with train movement is least, a consideration of much weight on a busy line. The rivalry created between various portions of a force such as this also increases materially the amount of work done by the gangs.

Locomotive cranes have also been employed advantageously in renewing bridge ties. Late last summer

1,522 8-in. by 12-in. by 12-ft. ties, amounting with elevation blocks to over 160,000 ft. B. M. of timber, were renewed in one track on a bridge across the Susquehanna river at Towanda, Pa., in 12 hours' working time with the assistance of two locomotive cranes. Each crane hauled behind it a flat car on which the new ties were piled in groups of 12, which were dropped onto the top of the deck girder spans ahead as fast as the old ties were removed and stacked on this same car. The track was laid with 100-lb. rails with 90-lb. guard rails and the new ties were tieplated solidly as laid. All ties had been framed in advance and elevation blocks attached. The cost of this work, including the installation of two temporary crossovers, was 46 cents per tie, and it is believed that this would have been reduced to 31 cents if the work had not been delayed seriously by a storm. In another instance, 365 ties were renewed by a similar method on a single-track bridge at a cost of 20.4 cents per tie.

Another class of work in the handling of which unusual records have been made has been the unloading of cinders. About 120 cars of cinders are made daily on the Lehigh Valley. Up to a few years ago they were considered a source of expense and were wasted to a large extent. Now, however, they are distributed systematically to the branch lines for ballast purposes and are also used for widening shoulders. A sufficient quantity is secured for all branch-line ballast requirements and in some instances to take out small sags in the grade line. The cinders are loaded into hopper bottom cars at the terminals and are sent out onto the line under the instructions of the engineer maintenance of way. As the cars arrive at the point of use, they are held on convenient side tracks until a sufficient number are on hand to require a work train for a full day. A heavy road engine is then sent out, which takes as many cars as it can handle conveniently to the point of unloading. Five or six cars are opened at a time, properly spaced through the train to distribute the cinders to the required depth, and they are then leveled off with ties placed in front of the truck of each car being unloaded. As fast as a train is unloaded, the cars are set out and another string secured. In this way 199 cars were unloaded on the Mahanoy & Hazleton division before 3 p. m. one day last summer. These cinders are placed under the track on the branch-line sections by the regular section forces in the same manner as stone ballast is put under on the main line.

Similar records have been made in unloading ties. As many as 128 cars, containing 28,000 ties, have been unloaded and distributed from coal cars by one work train in a day.

In making records such as this, as in other work, a large part of the results has followed the creation of a spirit of rivalry between divisions, supervisors and gangs. This spirit has been cultivated judiciously. The good performances of one division are made known to the others with information concerning the manner in which they were made. At the first opportunity other supervisors naturally try to excel the previous records.

Another measure to reduce labor is the loading of coal for the outlying pumping stations in 12-yd. air dump cars. These cars are forwarded in local freight trains and are dumped at the water stations with practically no delay, and without the necessity of sending a gang of men to unload the coal by hand. A considerable quantity of cinders is also loaded in these cars in the winter and unloaded along the line to widen banks.

By organizing especially for the work requiring the services of work trains and doing as much as possible when a train is employed, it has been possible to reduce the number of trains required materially. Previously, each supervisor operated one work train regularly and others as occasion demanded. Frequently as many as 20 such trains were out on various parts of the system at one time. This condition has been done away with and trains are now ordered only as required. A greater attempt is made to house the gangs on the work and to provide them with motor cars, as a result of which no trains are now required to haul the men over the road. Also, as when unloading rails, cinders or ties, an effort is made to secure the maximum amount of work from a train when it is ordered. As a result the average number of work trains employed on the system is now about 1 2/3 daily.

This same principle has been employed when one track on double-track lines is taken out of service because of maintenance operations as when relaying rail. Instead of ordering out a pilot engine to precede trains moving over the single-track section, a motor car is run back and forth with a trainmaster in charge, effecting a material saving over the cost of an engine and crew.

Pneumatic tie tampers are now being experimented with and in all of the large yards where air pipes are installed the pneumatic tie tampers are used. In addition to this, seven portable four-machine air tampers are in use with a view to eventually supplanting manual labor for tie tamping with power.

BRANCH LINE BALLASTED WITH CINDERS

HANDLING MATERIAL

As far as possible, all work for the year is included in an annual program prepared at the beginning of each fiscal year. This estimate includes all materials such as ties, rails, track fastenings, tie plates, switches, etc. After it is approved, the auditor charges out one-twelfth of the account on the books monthly. The labor item is, therefore, the only charge affected by business conditions and subject to fluctuation.

After this system budget has been approved the engineer maintenance of way gives each division a monthly appropriation. These appropriations are in turn distributed by the division engineer between the different supervisors under the direction of the engineer maintenance of way. Similar appropriations are made monthly for special work not included in the regular maintenance of way budget.

To insure the proper accounting for all labor and material, two accountants are assigned to the office of the engineer maintenance of way, who visit the offices of the various supervisors, check their material and labor accounts and make test inventories from time to time. In

this way it is possible to detect errors while fresh in mind which would otherwise accumulate and become difficult to discover later. This practice has been found to result in a great improvement in the records.

Close attention is given to the handling of new and scrap materials. Each track, bridge and signal supervisor has a small storehouse at his headquarters, where he keeps one month's stock of materials used in his department. Supplies are sent to these local storehouses by the general storekeeper on requisitions approved by the engineer maintenance of way, after being compared with the supplies reported on surplus material reports made monthly. As far as possible the requisitions are filled by transferring material from other divisions rather than by ordering from the storekeeper. Once each year a committee composed of the general storekeeper, the engineer maintenance of way and the superintendent of motive power make a detailed inspection of the system, checking all supplies on hand, collecting surplus and obsolete material and preventing the unnecessary accumulation of supplies out on the line.

Two principal scrap platforms are maintained at Sayre, Pa., and Packerton, both of which are operated by the stores department. All small scrap is shipped direct to these points. The maintenance of way department has a man stationed at each of these scrap platforms, who reclaims all usable track materials sent in as scrap. All such material reclaimed is held for the inspection of the supervisor who sent it in. As a result of this plan very little usable material is sent in as scrap.

All frog and switch materials taken out of track are sent to Weatherly, Pa., where a frog and switch shop is operated by the mechanical department for the manufacture and repair of frogs, switches, and other special track work. The normal requirements of the road for these materials are filled here for all but manganese construction, which is purchased from the manufacturers. Switch stands and similar material are also repaired here, but track tools are repaired at the local shops on each division.

BRIDGE MAINTENANCE

A bridge inspector is assigned to each division, reporting to the supervisor of bridges and the division engineer, who spends his entire time inspecting bridges and large roofs on his territory. A general bridge inspector inspects all large bridges on the system. Each fall the general bridge inspector makes a careful inspection of all structures, accompanied by the division engineer, bridge supervisor and local bridge inspector. Based upon the information secured at this time, the program of repairs for the following season is made up.

All painting is done by local division forces. A foreman painter is employed permanently on each division, who builds up his gang each spring. In the same way a mason foreman and gang handle the work of this nature on each division.

All bridge deck timbers and ties are creosoted, special care being taken to see that the timbers are treated uniformly with no excess oil on the surface, to create a fire hazard. To prevent the prevalent low spots at the ends of bridges, six 10-ft. ties are placed at each end of each structure to give increased bearing at those points.

A form of special equipment which is yielding good returns is a portable saw mill. This was first secured to reclaim a large amount of lumber from a coal storage building, which was being dismantled at Perth Amboy a year ago. Since that time it has been moved from place to place over the road to reclaim bridge timbers and to saw up timber cut along the right of way.

A practice which has been working out very satisfactorily during the last two years has been the replacement of plank street and highway crossings with macadam as fast as they require renewal, except at certain crossings of very heavy traffic. When placing this type of crossing, the track rails are first cleaned and painted with asphaltum. The ballast next to and under the rail is also thoroughly mixed with this material to prevent the loss of current from the signal circuits. The remainder of the track is then filled almost to grade with the regular stone ballast and is covered with screenings. In this way the cost of maintenance is materially reduced, the danger of the planks being forced up by the frost or ice in the winter is eliminated and smoother crossings are provided for the highway traffic. Practically the same construction has been adopted for platforms at a number of the smaller stations. An additional safeguard to highway traffic has been the installation of Hall disc signals released from main line service, at obscure points to warn highway traffic of approaching trains.

STAFF MEETINGS AND INSPECTIONS

Regular meetings of the men in this department are held regularly to discuss current problems. Every two months a meeting of the general manager, superintendent of transportation, engineer maintenance of way, superintendent of motive power and all division superintendents is held to discuss operating matters of common interest to these departments. Similar meetings of the engineer maintenance of way, inspector maintenance of way, hydraulic engineer, signal engineer and division engineers are held regularly. The supervisors of bridges and buildings compose a committee which meets every two months. Each division superintendent also holds a meeting with his staff every two weeks.

Each fall an annual inspection is made over the main line, passing over both main tracks. This inspection is conducted by the general manager, accompanied by the engineer maintenance of way, all division superintendents, division engineers and supervisors and four of the older track foremen selected from different sections from year to year. Frequently general officers from other departments accompany the inspection, making a party of about 40 men. Each division and section is rated and the results announced but no prizes are awarded.

By this and similar measures the efficiency of this department has been increased, the standards of maintenance have been raised, more work has been done and the expense per unit of work done has decreased.

We are indebted to G. L. Moore, engineer maintenance of way, for the opportunity to collect the information contained in this article.

TRACK SCALE SPECIFICATIONS

THE United States Bureau of Standards has issued a 28-page circular containing a proposed new specification for track scales. The specifications are much longer and go into much more detail than those of the American Railway Association.

The major portion of the circular is devoted to a method for determining the capacity rating, concerning which there is much confusion at present. This method follows the general principles used in the design and investigation of truss bridges whereby the position of the load for the maximum effect on each individual part of the structure is determined, and having found this position, the stress in the particular part is calculated. An attempt is made to reduce this to formulæ giving the relation between the loads and the stresses. The methods given purport to reduce these to tables and diagrams eliminating nearly all actual calculations.

HOLDING LABOR ON RAILROAD WORK

Discussions of the Present Situation—Means of Alleviating the Shortage by Making Conditions More Attractive

THE railways are now facing the most serious labor shortage in recent years and the indications are that it will become more acute as the season develops. This has forced maintenance of way officers to give much attention to this subject and will undoubtedly lead to a marked improvement in working conditions which will retard if not prevent similar recurrence in the future. The discussions presented below point out some of the ways in which railway conditions can be made more attractive to labor.

ALLEVIATING THE LABOR SHORTAGE

By E. R. Lewis

Assistant to General Manager, Duluth, South Shore & Atlantic

The railway labor problem for 1916 presents more than ordinary difficulties to the intended employer. We have become accustomed to expect the labor market to fluctuate with the local supply and demand. When times are hard, when industrial concerns are doing little, and railway maintenance is being held to a minimum, labor is comparatively cheap and sufficient. The opposite of these conditions results in like changes in the price and supply of labor. But the world's war has stimulated many manufactures and has created new fields of employment. The mandates of war have drawn many thousands of toilers away from the country to the trenches and to employment in war industries abroad. There is therefore a real shortage of labor in America at the present time.

But the present "plight of capital" has been more largely brought about by anticipation than by reality. There has been a nationwide advertisement by press and by word of mouth of an impending scarcity of labor, ever since war was declared. Our newspapers and our magazines, our writers and our readers, our manufacturers and our laborers have spread the dire predictions of a labor famine with persistence and with conviction, until the ghost is flesh and blood, the man of straw is endowed with life, and the labor bugaboo has become a real labor scarcity. It pays to advertise, especially when the world freely advertises for you. I say advertise, for that has been the effect, though not the intent, of the written and oral predictions of a labor famine in 1916. The gratuitous advertising has resulted in placing labor in its enviable present-day position.

No doubt there are less laborers in America to-day than when the world war began, but rumor has lengthened the shadow of the labor famine beyond all semblance of its real proportions.

Employers of railway labor began before winter ended to lay plans for an unusually early start at maintenance work in the spring, on the theory of "first come, first served." There were organized many maintenance gangs which were allowed to mark time by shoveling snow till the frost went out, in order to retain the organizations against efforts of later entries into the field to hire the men away by the lure of higher wages. The late bidders' prices were often met by the first employers in order to hold the men, with the result that wages have soared and labor has become more arrogant. These early sparrings for an opening have led to the ruin of the labor situation. There will be "eight hours' work for ten hours' pay" this year as the ultimate result of these runs to cover of the captains of industry, frightened by the shadow of impending labor famine.

But money is fortunately not everything in this world. There are other considerations of value both to the man you hire and to the man up higher. These other considerations depend on the points of view of those directly interested. The kind of labor hired has much to do with the case. The conditions under which the laborer labors often mean as much to him as the wage he earns.

In order to meet the labor situation successfully each employer must studiously consider his own individual problems. He must make a detailed survey of the labor markets within his reach, of the total supply of labor in each district, of the demands upon that supply, of the wages paid and of the inducements offered by competing employers. Knowing his source of supply and his competition, the employer must know his employees and be prepared to so treat them as to retain their services after he gets them. Men of different nationalities differ as do classes and individuals. Each kind of labor demands a special treatment to obtain the best results. A thorough understanding of type is the key to the situation. The employer must get to the bottom of this question and solve it himself. It is no abstruse problem, but it requires close attention and a keen insight into human nature. The men of northern Italy differ markedly from those of southern Italy. Scandinavian laborers are not all "Dutch," nor are Japanese and Chinese alike. Men of these various nationalities require treatment to fit their several needs.

The employer must understand his men, their wants, their objects in seeking his employ, their customs, preferences and opinions. It is possible even through an interpreter to gain the understanding, confidence, respect and good will of any body of workmen. But it takes time and attention to begin with, and periodical study thereafter to bring about and to retain that perfect understanding which is necessary to get the best mutual results to labor and to capital. Put yourself in the laborer's place. What would you think of the proposition from his standpoint? The foreman and the assistant foreman are his direct superiors. What do you think of them? What would you think of them as your superiors? Do they understand the laborer? If not, change them for men who do understand him and who will treat him properly. Consider the men's food, customs and home life. The first is by long odds most important. Men of all classes are alike in this respect. Feed them well, house them well, organize them well, and officer them well. You then will invariably have a better class of men, better satisfied men, and harder working men than your competitors, who pay as much, or possibly more, than yourself.

Nothing demoralizes an organization quicker than idleness. It is noteworthy that an army in waiting is a difficult proposition. Hard work makes, as idleness unmakes men in all walks of life. Provide, then, for the rainy day. Provide work to keep the men busy—work that counts—work that the men know to be worth while.

The very careful training in these matters of the foremen and assistant foremen will usually produce the desired results, provided they are the right kind of men. It is relatively as important to hire foremen with executive ability and brain power as to engage system officers

with like qualities. Then give your foremen requisite authority to handle the situation properly. There are many cases where the food question may be given over to the men themselves, the buying and preparation being done by one or more of the workmen's representatives. In military parlance, they are permitted to run their own mess.

The practice on some roads of hiring and paying cooks for bridge and other small gangs and letting the food be bought by the foreman and the costs charged and collected by him against each man according to his proportion of the total cost per month, has met with marked success. It is well known that boarding contractors cannot make ends meet if they have only a few boarders. Both parties are early dissatisfied; the men with the food and the contractor with the finances. For this reason the co-operative plan is advisable for gangs of 15 men or less.

It is of primary importance to provide comfortable and cleanly quarters for all laborers. It is no less important to make the men keep the quarters clean, to keep themselves free from vermin and to take individual pride in the conditions about their camps. It is well to have the foreman and assistant foreman eat with the men, to allow no favoritism as to special dishes, to taboo free meals absolutely, to insist on promptness, on wise selection of foods and on proper variety and alternation in menu.

The fault is that too often there is no one of proper caliber to consider and insist on these camp comforts which mean so much more than the casual observer might think.

When a railway company has an established reputation for hiring good men, paying a fair wage, providing good quarters, working the men to the best advantage, maintaining good discipline, and giving fair treatment to all, the foreman can pick and choose. The gangs will weed themselves. Cleanly camps will not permit uncleanly men to remain. A sober gang will not tolerate disorderly laborers. There is no real difficulty about retaining labor. Understand the men, give them the consideration due them, be just to them, give their problems intelligent attention, feed and house them in cleanly and reasonable comfort. The cost of supervision necessary to these ends will be returned many fold.

IMPROVING LABOR CONDITIONS

BY ROADMASTER

The serious shortage of labor with which the railways are now confronted is not a temporary condition; therefore, remedies should be adopted at an early date. Prompt action is necessary to avoid the serious deterioration in the physical condition of much track. Those lines which have been maintained in good condition in recent years can stand a reduction of forces for a time, but a postponement of improvement work even on such lines only means greater effort later.

One of the necessary measures to meet the present situation is a wage that will enable a railroad to compete with other industries in occupations where no more skill is required than in track work. Permanent employment in so far as it can be adopted economically will also assist materially in the solution of this problem. I find that at the present time our forces are limited to the number of men employed during the late winter, although we have made every effort to increase our regular section forces and have raised the wages 25 cents per day since March 15. However, wages alone will not solve the present difficulty, although with a rate more nearly equal to that paid by factories and other industries a sufficient force can be secured locally in many instances where the roads are now short of men.

More supervision of track work is necessary. The adoption of every possible labor-saving device is also essential, effecting in this way a reduction in the number of men necessary.

The adoption of cut-throat methods, such as making unreasonable concessions to foreign laborers, ought to be avoided in a season such as this. Fair treatment should be accorded track laborers and full efficiency should be required of them.

The most important improvement which can be made is the distributing of maintenance work throughout the year. A number of roads are now endeavoring to get their heavy improvement work completed early in the season so that they may be able to assign the available forces later to the work of preparing the track for the coming winter.

I believe that the conditions confronting American railways at the present time will lead to important changes in the methods of conducting work in the maintenance of way department. This will include the more general contracting of such work as can be done that way, the organization of special gangs for fence repairing, renewal of plank crossings, etc., enabling the track forces to work exclusively on the track.

PRACTICAL SUGGESTIONS

BY TRACK MAN

Industrial districts are now experiencing one of the busiest periods of activity in history. Mills, factories, mines and railroads are being worked to capacity, and large extensions of plants are being made. As a result common labor is at a premium. This in connection with the fact that a great many laborers have returned to Europe has created a demand much beyond the available supply. The shortage is particularly noticeable on railroad work for the following reasons:

1. The Italian was generally employed on many roads until a year ago, being preferred because he adapted himself more easily to the living and working conditions than did men of other nationalities. A large percentage of the Italians have returned to Europe, so that the departure of this particular nationality has been more serious as far as the railroads are concerned than it would have been had it been confined to some other nationality.
2. The conditions under which men must work and live on railroad work do not suit the men now available as well as do the conditions and mode of living in industrial towns. This is especially true of the Austrian, Slav and Greek.
3. Wages on railroad work are lower than those paid in other industries.
4. Railroad work has in the past been a seasonal occupation and so has not offered permanent employment.

Heretofore there has usually been an adequate supply of labor and during a large part of the time there has been a surplus, the result being that little serious study has been given to the securing and holding of men. As a matter of fact, the problem has been to get authority to put on as large a force as those in immediate charge of maintenance work considered necessary. Now the conditions are reversed and serious attention is being given to the problem of holding and conserving what labor is to be had.

The laborers are keenly alive to this condition and as a result they are less efficient and are moving from place to place, attempting to secure higher wages and concessions as to conditions of living and hours, creating a general spirit of indifference and unrest. Again many

roads are turning to the professional employment agent for help and many of these agents are simply exploiting both the roads and the men.

Railroads cannot hope to compete with the manufacturers or contractors on wages. While it is believed that some advance in wages is necessary in order to hold anything like an adeqate force, it seems that there is a much more profitable field in bettering the conditions under which the men live and work. To do this one must understand the habits and characteristics of the different classes or nationalities used and meet the mode of living which these different groups demand as nearly as possible. In the past the men have had to put up with conditions they were not used to and did not like. At present they are in a position to choose, so that the road that studies those features and most nearly meets the desires of the men will be the most successful in holding them under present conditions.

In the past very little if any distinction has been made between the different classes of men that should be used on section and extra gang work. The general run of Slavs, Austrians and Greeks prefer and at the present time insist on working or at least living in large gangs. It is a waste of time and effort to try to split up large gangs. Special effort must therefore be made to get men on the sections. For this men must be secured who are willing to work in small gangs and to provide and cook their own food. In order to accomplish this, living quarters must be provided as convenient and comfortable as possible and section headquarters should be established in villages and towns.

There are several reasons why men prefer to be in large gangs. For instance, the Austrian and Slav do not want to cook for themselves. They want, and, in fact, usually insist, on having their meals cooked for them. Again, they are meat eaters and want fresh meat every day. This means that quarters must be provided for women, or a man cook must be employed, and this can only be done when a sufficient number of men are together to justify employing a cook and arranging for fresh meat and other food.

The men are usually directed by a gang leader who controls 40 to 50 men and it is practically impossible to separate these men from him. With the hobo and to a certain extent the Greek, a commissary run either by a commissary company, the railroad or by the men themselves is necessary. In these commissaries the men are charged so much a meal and something for bedding and other service. It is simply a waste of time to send out from a large center a gang of men who usually have no clothes but those they wear, no money and no bed clothes, unload them at some small station, crowd them into cars or buildings in which there is nothing but a few stoves and wooden bunks and expect them to go to work. Provision must be made for food, bedding and credit until they are paid. It is the neglect of these obvious necessities that accounts for the inability of some roads to keep their forces.

It is the usual practice to house men in camp cars. It would be difficult to devise a more uncomfortable, unsanitary, inconvenient method (as far as the men are concerned) of housing men than this. While it is recognized that cars offer some advantages in that the men can be moved quickly from place to place, it is believed that this kind of shelter is not only unsuited for the purpose except under special conditions, but is also more expensive than buildings. While it may be necessary to have some forces in cars, a large part of the men can be located in buildings in selected locations.

The common box car is poorly lighted, it cannot be ventilated, it is hard to heat in winter and is hot in summer, it will only hold eight men without crowding, it is usually set near or alongside a main track or yard, a dangerous place for the men; it is liable to be involved in a derailment, it is frequently moved so that men and contents are disturbed and is often placed where rest cannot be had day or night. A box car is usually fitted up with bunks for 16 men and contains about 2,100 cu. ft. or 130 cu. ft. per man. In connection with the small windows and the location of the doors the lack of ventilation is obvious. A minimum of 200 cu. ft. per man with reasonably good means of ventilation should be provided.

A 16-ft. by 40-ft. building, housing 24 men, will provide 5,500 cu. ft. and the openings can be spaced so that ample light and ventilation are secured. Such a building will cost $600 or $25 per man. A box car is worth at least $200 for scrap and if fit for revenue service $500, or an average of $320, or $20 per man. If the number of men is reduced to eight, the cost is $40 per man. These figures for the box cars are probably low, showing that there is no economy in their use. With the serious objections to the box car mentioned above it is believed that they should not be used unless it is absolutely impossible to use buildings.

If a building is provided the following conditions should be met:

1. The camp site should be carefully selected, having in mind good drainage, a location that is not noisy, that can be reached by wagons so that supplies can be hauled in, and easy of access so that the men can get to and from work conveniently. The location should be near a town if possible so that the men may have whatever advantages the town offers in the way of picture shows or other means of entertainment. If not located near a town, it should be near a station so that train service is available.

2. The building or buildings should be amply large to take care of the men. Overcrowding is one of the worst features of railroad camps. The buildings should be well lighted and ventilated, and built in such a manner that they will be warm in winter and reasonably cool in summer. If wood bunks are used they should be built two high, each stand accommodating two men. The bunks should be built separate, not attached to the building, so that they can be moved out when the building is cleaned and fumigated (which should be done regularly). There should be at least 30 in. between each set of bunks. Plenty of stoves and a separate building for cooking and eating should be provided.

3. An ample supply of good water must be had at the camp. It is not safe to depend on springs, and usually the water supply is too far from the camp. A drilled well is much better if it is possible to get water in this way.

4. No liquor should be allowed in the camp openly. Of course, some of the men will drink, but a large part of the drinking is due to the assumption on the part of foremen and railroad officers that the men must have liquor and nothing is done to discourage it. As a matter of fact, the men are being exploited by commissary men and liquor agents and a large part of the drinking can be done away with if reasonable attention is given to this feature.

One very important matter bearing on the inability of railroads to hold men is the attitude of contempt on the part of foreman and others in authority towards the foreigner. The men are usually treated in an overbearing manner, called hunkies, dagoes, etc., and as a result are resentful and sullen. A man will measure up very

largely as to what you expect from him. If little is expected and he is treated with contempt it is unlikely that he will do more than is expected.

Summing up, to hold forces under present conditions, the following changes are necessary:

1. Provide better living quarters, using box cars as little as possible.
2. Provide permanent employment.
3. Select men for large or small gangs as the case may be—using men who are willing to cook for themselves in small gangs.
4. Grant a moderate increase in wages.
5. Work out at each camp a method of running a commissary, either in charge of a cook or a commissary company, or preferably by the railroad company.
6. Track foremen and others who come in direct contact with the men should treat them fairly with patience and consideration.
7. Discontinue the very general practice of paying men overtime they do not make. A number of roads are paying eleven hours for ten hours' work to avoid raising the rate per hour. This is dishonest and unfair both to the men and to the railroad company. It creates dishonest foremen and stores up trouble for the future.
8. Do not work men for an unreasonable length of time. Frequently at wrecks or emergencies it is common practice to work them from 18 to 30 hours and usually no provision for food is made. This is unfair. It should be possible to arrange for food on any road if the men are out overtime, and in any case a relief should be on the ground after the men have worked 16 hours.
9. Do not send men unreasonable distances by hand car. If necessary to move them more than two miles, use a work train or motor cars.
10. Do not expect the men to pump a hand-car to or from work on their own time. It is real work and should be paid for.

The Principal Causes of Rail Failures*

BY W. C. CUSHING

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FROM January 26, 1909, to December 16, 1912, there were 4,330 rail failures in 1,790 miles of single main track, being 60 failures for each 100 miles of track per annum. These were not all *broken* rails, but represent the sum total of all kinds of failures.

It is not practicable to make a complete survey of the chemical condition and physical properties of every rail which fails, when they are so numerous, and therefore it has been our custom to select at random rails which have failed in the different ways indicated by the "classification." For the purpose of this study there has been surveyed the following number of each classification:

1.	Broken	286
2.	Flow of Metal	15
3.	Crushed Head	19
4.	Split Head	153
5.	Split Web	18
6.	Broken Base	42
7.	Damaged (without fracture)	2
	Worn out in service	68
	Total	603

One is struck with the large number of rails which have broken at a time when the roadbed was frozen, 203 out of 286, or 71 per cent. Furthermore, 96, or one third of the fractures, occurred within the limits of the joint. If there was no fault to be found with the material, this would be a clear indication that the margin of safety of the rail under ordinary service conditions was quite small, because when the conditions became unusually severe, as in the case of a long-continued frozen roadbed, the rails immediately began to break, and, to a considerable extent, at the weakest point, namely, the joint.

In the case of 12 breakages in the joint only does one fail to account for the additional weakness at that point by defective material. In 21 of the rails, slag was present. As 19 of these were of the P. S. section, which was introduced with the year 1908, it would appear that the methods used by the mills for pouring ingots are not as good as those formerly used, or there is increased carelessness on the part of the workmen.

In the great majority of the rails studied, the fracture has been a simple one, that is, the rail broke into two parts and no accident resulted on account of being discovered in sufficient time by the trackmen. Occasionally, however, a rail flies into many pieces, and it is usually the cause of a train wreck. Such failures are the most dangerous and the most to be dreaded.

A few rails which broke shortly after a broken wheel

STATEMENT OF RAIL FAILURES FROM JANUARY 26, 1909, TO DECEMBER 16, 1912, CLASSIFIED AS TO KIND OF FAILURE, SECTION, PROCESS AND WEIGHT

Pennsylvania Lines West of Pittsburgh—South West System

Wt.	Section	Process	Broken	Kind of Failure: Flow of Metal	Crushed Head	Split Head	Broken Web	Split Base	Total Failures
100	A. S. C. E.	Bessemer	100	4	59	156	13	3	335
100	P. S.	Bessemer	51	29	23	94	12	...	209
100	P. S.	O. H.-A.	3	...	1	...	1	...	5
100	P. S.	O. H.-B.	5	1	...	6	5	...	17
100	A. R. A.-A.	Bessemer	3	...	4	113	10	...	130
85	P. R. R.	Bessemer	43	6	35	315	17	7	423
85	A. S. C. E.	Bessemer	373	67	366	1279	129	87	2301
85	P. S.	Bessemer	202	12	211	326	73	35	859
85	P. S.	O. H.-A.	...	7	18	...	...	...	25
85	P. S.	O. H.-B.	2	2	5	10	1	1	21
85	P. S.	OH Mayari	5	...	...	...	...	...	5
Total			787	128	722	2299	261	133	4330

*Abstracted from Bulletin No. 185, American Railway Engineering Association.

passed over them were examined in order to ascertain if such fractures occurred only when the metal was of poor quality, or whether the fractures occurred because of the additional punishment by the broken wheel when the metal was of fairly good quality. While in all of the examples the roadbed was frozen at the time, yet the material was reasonably satisfactory except in one case, which was above the average of hardness and had a rolling seam in the base.

The rails classified as "flow of metal," "crushed head," "split head" and "split web" are treated under the heading "Defective Heads," because what appears to be one defect is often another when cut open and examined. It is also rather difficult at times to distinguish between "flow of metal" and "crushed head."

It will be noticed from the table that "defective heads" were very numerous during the period in question, 3,410, and that 2,299 of them were classified as "split heads." Of the total, 205 were examined, or surveyed, and the results are tabulated. The first thing noticeable in examining the tabulation was that scarcely any of the failures have occurred in the joints, and the condition of the roadbed has no important bearing on the problem. Segregation, however, is an almost-invariable companion of the defective head and web, and that is nearly always accompanied by one or both of the other defects, brittleness and hardness. Sometimes slag is present and sometimes foreign steel, due to the cutting or protection of the ingot mold stool, but an examination of a rail with a bad head will nearly always disclose segregation, brittleness and hardness. One or two of them is sometimes absent. A split head, however, very rarely occurs without the accompaniment of one or more of the defects, which is pretty positive proof that the metal will stand up under the load if it is homogeneous and free from defects. It is the general custom now to have the rails stamped with letters to designate their location in the ingot, with the object of tracing defects back to the ingot in the study to bring about improved mill practice. The rails are stamped "A," "B," "C," etc., beginning with the top. The foreign steel is, therefore, usually found in the rails, from the lower part of the ingot. Sometimes old scrap tieplates were used for stool protection, and the shape of the plate was still discernible in the rail section. These discoveries brought about the discontinuance of the practice.

The results of the examination of so many "split head" rails seem to show that they are nearly always found in segregated rails having hard, unsound metal in the interior and softer metal at the surface. The flow of the softer metal develops a split in the harder unsound and less ductile metal in the interior of a badly segregated rail, resulting in a split head. The remedy seems to be to reduce segregation by making sounder and more homogeneous ingots, which can be done by the use of a sink head, as advocated by Sir Robert Hadfield.

The sources of trouble are not ended with the production of a sound ingot. Greater care should be exercised in blooming and rolling, and improved methods should be introduced. Previous studies indicate that the large and heavy reduction in the blooming rolls is injurious to the finished product, as it initiates the cracks which result later on in seams, which have been responsible for many failures, especially broken bases. The remedy seems to be lighter reductions. Base breakages have been practically eliminated by the heavy base of the 100-lb. P. S. section, but that is not the correct way to remove the defect, which still exists in the case of the 85-lb. P. S. section, which has a heavier base than was customary in former practice. These heavier bases were introduced primarily to make the rolling conditions better by equalizing more nearly the areas of metal in head and base. The rails come out straighter on the cooling beds, and thus the amount of "gagging" has been reduced.

These cases of long service rails and rails worn out in the tracks seem to show that high carbon is not the only consideration for more durable material, as rails with low carbon have lasted longer under the same conditions than rails with higher carbon, though this is by no means always the case. The temperature of rolling is undoubtedly a very strong if not the strongest factor in producing homogeneous and durable material.

PENETRATION OF PRESERVATIVES

By Lowrie Smith

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THE unit of measurement employed for designating the amount of creosote used in treating sawed structural material, which consists almost entirely of the heart portion of conifers, and in which the penetration of the preservative is limited to a comparatively shallow depth, is considered unsatisfactory by many. It is not based on any scientific reasoning and is apparently an arbitrary unit that was adopted for lack of anything better.

In the treatment of material of this kind the question of first importance in deciding the amount of preservative to be used is the amount of surface exposed to treatment and the protection desired, not the cubical contents. The practicable penetration being limited to a comparatively shallow depth, that portion of the timber beyond this treatable zone should not be considered.

Size	12-in. by 16-in. 16 ft.	2-in. by 6-in. 16 ft.
Volume in cu. ft.	21.30	1.33
Superficial area in sq. ft.	77.4	21.4
Ratio of area to volume.	3.54	16.15
Total oil injected in lbs.	170	11
Lbs. of oil per sq. ft.	2.20	0.51
Depth of oil in ins.	0.41	0.09

The great variation of the ratio of the superficial area to the volume of pieces of timber of different cross sections has never been realized or given due consideration. Feeling that more information along this line would be of interest to the producers and users of creosoted material, the accompanying table was prepared, the intention of which is to give a comparison of the treatments of timbers of different cross sections with the same, and also different amounts of creosote oil per cubic foot of volume.

An example of its use may be shown by taking two extremes, a 12-in. by 16-in. 16-ft. timber and a 2-in. by 6-in. 16-ft. timber, given the same treatment of 8 lb. of oil per cubic foot. While both sticks are given the same amount of oil per cubic foot, the larger has about 4.5 times as much per square foot of superficial area and that the depth of this oil is about 4.5 times greater than in the smaller. By following across the table horizontally on the 2 by 6 line it will be seen that even with a treatment of 25 lb. per cu. ft., which is the practicable limit, it is impossible to get more than 1.49 lb. per sq. ft., or 68 per cent of that obtained with 8 lb. on the larger size. Also, the average treatment given a charge made up of timbers of varying cross sections receiving a specified amount of oil per cubic foot, can be computed by dividing the total amount of oil required, in pounds, by the total square feet of superficial area, which will give the pounds per square foot. Reference to the table will show that this amount per square foot is a certain depth, and will indicate whether or not

by that treatment it is reasonable to expect certain required results. This same information may be obtained by multiplying the pounds per square foot by the factor 0.1833, which is the depth of a pound of oil over a square foot of surface.

The table was not prepared with the intention of trying to establish any definite criterion for judging the penetration to be obtained from a given treatment, the impossibility of this being very apparent to anyone

All things being equal, the depth of penetration of a given amount of oil per unit of volume would vary inversely with the ratio of the superficial area to the volume, and that the penetration of a given amount of oil over a given area would vary directly with the amount.

In formulating the rule and compiling the table the variations of the density of the oil throughout the limits of penetration, and the lap of penetration on the corners and edges, were ignored; the depth of a given amount of

Size	Lgth.	Bt.B.M.	Vol. Cu. Ft.	Perimeter In.	Perimeter Ft.	End Area Sq. Ft.	Superficial Area Sq. Ft.	Ratio of Area to Volume	Pounds Per Cu. Ft. 8 lbs.	8 In.	10 lbs.	10 In.	12 lbs.	12 In.	14 lbs.	14 In.	16 lbs.	16 In.	18 lbs.	18 In.	20 lbs.	20 In.	22 lbs.	22 In.	24 lbs.	24 In.
16 X 12	16	256	21.30	56	4.67	1.33	77.4	3.64	17		213		256		298		341		383		426		468		512	
									2.20	.41	2.75	.51	3.31	.61	3.86	.71	4.41	.81	4.95	.91	5.50	1.01	6.05	1.11	6.62	1.21
14 X 12	"	224	18.65	52	4.33	1.17	71.6	3.84	149		187		224		261		298		336		373		41		447	
									2.08	.37	2.65	.49	3.15	.57	3.65	.67	4.16	.76	4.70	.86	5.21	.96	5.73	1.05	6.23	1.14
12 X 12	"	192	16.00	48	4.00	1.00	66.0	4.13	128		160		192		224		256		288		320		352		384	
									1.94	.35	2.49	.45	2.91	.53	3.40	.62	3.93	.71	4.35	.80	4.85	.89	5.34	.98	5.82	1.07
10 X 12	"	160	13.33	44	3.66	.83	60.2	4.52	105		133		160		187		213		240		267		293		320	
									1.74	.32	2.22	.41	2.66	.49	3.11	.57	3.64	.65	3.99	.73	4.44	.81	4.87	.89	5.33	.98
8 X 12	"	128	10.68	40	3.33	.65	54.6	5.12	85		107		128		150		170		192		214		235		256	
									1.86	.69	1.96	.36	2.34	.43	2.75	.50	3.14	.58	3.52	.66	3.92	.72	4.30	.79	4.70	.86
6 X 12	"	96	8.00	36	3.00	.50	49.0	6.15	64		80		96		112		129		144		161		176		192	
									1.30	.24	1.63	.30	1.96	.36	2.29	.42	2.61	.48	2.94	.54	3.27	.60	3.59	.66	3.92	.72
4 X 12	"	64	5.33	32	2.66	.33	43.2	8.10	43		53		64		75		86		96		106		117		128	
									.99	.18	1.24	.23	1.51	.28	1.74	.32	1.97	.36	2.23	.41	2.46	.45	2.71	.50	2.96	.55
3 X 12	"	48	4.00	30	2.50	.25	40.5	10.15	32		40		48		56		64		72		80		88		96	
									.79	.14	.99	.19	1.17	.22	1.39	.25	1.58	.29	1.78	.33	1.97	.36	2.17	.40	2.37	.44
2 X 12	"	32	2.66	28	2.33	.16	37.6	14.15	21		27		32		37		43		49		53		59		64	
									.57	.10	.71	.13	.5	.16	.99	.18	1.14	.21	1.28	.23	1.41	.26	1.57	.29	1.70	.31
16 X 10	"	213	17.75	52	4.33	1.11	71.5	4.03	142		177		212		247		282		319		353		389		425	
									1.98	.36	2.45	.46	2.97	.54	3.45	.63	3.95	.72	4.45	.82	4.93	.91	5.43	1.00	5.96	1.09
14 X 10	"	187	15.57	48	4.00	.97	65.9	4.23	125		156		187		219		229		281		311		342		374	
									1.90	.35	2.36	.43	2.84	.52	3.31	.61	3.78	.69	4.25	.73	4.73	.86	5.19	.95	5.68	1.04
12 X 10	"	133	11.10	40	3.33	.70	54.7	4.92	79		111		133		155		177		200		222		244		266	
									1.63	.31	2.03	.37	2.44	.45	2.84	.52	3.24	.59	3.66	.67	4.07	.75	4.47	.82	4.87	.89
8 X 10	"	107	8.93	36	3.0	.56	49.1	5.51	71		89		107		125		143		161		179		196		214	
									1.45	.27	1.82	.33	2.18	.40	2.54	.47	2.92	.53	3.28	.61	3.65	.67	4.00	.73	4.37	.80
6 X 10	"	80	6.65	32	2.66	.42	43.4	6.55	53		67		80		93		106		120		133		146		160	
									1.25	.22	1.64	.29	1.98	.34	2.16	.39	2.5	.45	2.77	.51	3.18	.56	3.37	.62	3.70	.68
4 X 10	"	53	4.42	28	2.33	.28	37.9	8.60	35		44		53		62		71		79		88		97		105	
									.92	.17	1.17	.21	1.43	.26	1.64	.30	1.83	.35	2.38	.38	2.58	.43	2.56	.47	2.90	.51
3 X 10	"	40	3.33	26	2.16	.21	36.0	10.55	27		33		40		47		53		67		77		73		80	
									.77	.14	.95	.17	1.14	.21	1.54	.25	1.31	.29	1.72	.32	1.93	.35	2.9	.38	2.89	.42
2 X 10	"	27	2.25	24	2.0	.14	33.3	14.35	18		25		27		36		36		41		25		29		.54	
									.66	.10	.89	.13	.24	.15	.99	.17	1.11	.20	1.27	.23	1.92	.26	1.52	.28	1.67	.31
16 X 8	"	171	14.23	48	4.00	.90	65.8	4.63	114		142		171		199		228		256		284		312		341	
									1.73	.32	2.19	.40	2.63	.48	3.06	.56	3.46	.63	3.89	.71	4.33	.79	4.75	.87	5.19	.95
14 X 8	"	149	12.45	44	3.66	.78	60.1	4.93	90		112		135		157		180		202		225		247		270	
									1.65	.30	2.07	.38	2.51	.45	2.39	.53	3.31	.61	3.73	.68	4.15	.76	4.55	.84	4.97	.91
9 X 8	"	96	7.98	32	2.66	.45	43.5	6.13	57		71		85		99		113		127		142		156		170	
									1.31	.24	1.63	.30	1.96	.36	2.29	.42	2.61	.48	2.93	.54	3.26	.60	3.59	.66	3.92	.72
6 X 8	"	64	5.33	28	2.33	.33	38.0	7.15	43		53		64		75		86		96		107		117		128	
									1.13	.21	1.40	.26	1.62	.31	1.97	.36	2.24	.41	2.57	.46	2.82	.52	3.10	.57	3.37	.62
4 X 8	"	43	3.58	24	2.00	.22	32.4	9.05	29		36		43		51		57		64		72		79		86	
									.99	.18	1.23	.23	1.15	.26	1.54	.31	1.70	.35	1.97	.36	2.22	.41	2.42	.45	2.16	.49
3 X 8	"	32	2.66	22	1.83	.17	29.6	11.13	21		27		32		37		43		48		53		59		64	
									.71	.13	.9	.16	1.10	.20	1.25	.23	1.48	.27	1.62	.3	1.79	.33	1.96	.36	2.16	.40
2 X 8	"	21	1.75	20	1.67	.11	26.9	15.35	14		17		21		25		20		32		35		39		42	
									.52	.10	.65	.12	.77	.14	.93	.17	1.04	.19	1.22	.22	1.32	.24	1.43	.27	1.56	.29
16 X 6	"	128	10.65	44	3.66	.67	59.9	5.63	85		107		128		150		17		192		214		235		256	
									1.42	.26	1.75	.32	2.14	.39	2.49	.46	2.4	.55	3.21	.59	3.57	.65	3.92	.72	4.28	.78
14 X 6	"	112	9.35	40	3.33	.58	54.5	5.83	75		93		112		131		149		168		187		205		224	
									1.30	.25	1.71	.31	2.09	.38	2.43	.44	2.74	.50	3.08	.56	3.43	.63	3.73	.69	4.12	.75
6 X 6	"	48	4.00	24	2.00	.25	32.5	8.13	32		40		48		56		64		72		80		88		96	
									.99	.18	1.23	.23	1.48	.27	1.73	.32	1.97	.36	2.22	.41	2.46	.45	2.71	.50	2.96	.54
4 X 6	"	32	2.66	20	1.67	.17	27.1	10.15	21		27		32		37		43		48		53		59		64	
									.78	.14	.92	.17	1.17	.22	1.37	.25	1.59	.29	1.72	.33	1.96	.36	2.19	.40	2.36	.44
3 X 6	"	24	2.00	18	1.50	.13	24.3	12.15	16		20		24		28		32		36		40		44		48	
									.59	.11	.92	.16	.99	.16	1.18	.21	1.32	.24	1.43	.27	1.65	.30	1.81	.35	1.97	.36
2 X 6	"	16	1.33	16	1.33	.08	21.4	16.15	11		13		16		19		21		24		27		29		32	
									.71	.09	.82	.11	.78	.14	.99	.16	.98	.18	1.12	.20	1.26	.23	1.35	.25	1.49	.27

In column marked "lbs" top figures indicate total weight of oil in timber bottom figures indicate pounds of oil per sq. ft. of sup. area. Colum marked "in" indicates depth of this amount of oil over one sq. ft. of sur. area.

These figures based on oil having Sp. Gr. of 1.05 at 38°C=8.75 lb.per gal

1 pound= 26.4 cu.in. or .1833 inch over one sq.ft.of sup. area.

1/16 = .0625 5/16 = .3125 9/16 = .5625 13/16 = .8125

1/8 = .1250 3/8 = .3750 5/8 = .6250 7/8 = .8750

3/16 = .1880 7/16 = .4375 11/16 = .6875 15/16 = .9375

1/4 = .2500 1/2 = .5000 3/4 = .7500

In formulating the above rules and computing table, the variation of the density of the oil throughout the limits of penetration on corners is ignored, the depth of a given quantity of liquid over a given area being used as a basis as the table and rules are intended simply to give some kind of an idea of what to expect from a given amount of oil under certain conditions.

TABLE SHOWING PENETRATION AND AMOUNT OF OIL INJECTED INTO TIMBERS OF VARIOUS SIZES WITH DIFFERENT TREATMENTS

familiar with the treatment of timber, when the variations of refractoriness of wood in the same stick are considered, but simply to show the relation between the variables and give a rough idea as to what to expect. It would seem reasonable, however, to say that the average minimum depth of penetration of a given amount of oil per square foot of area can be assumed to be as shown in the columns marked "In," as this is simply the depth of a given quantity of oil over a given area without any consideration being given to the increased depth caused by the volume of the wood in which it is distributed.

The information developed by this table indicates that a rough rule for penetration would be:

oil over a given area being used as a basis, as it was intended simply to give some kind of an idea of what to expect from a given amount of oil under certain conditions. The table in its present form was made to cover as many variables as possible for individual conditions; it can be greatly condensed and simplified by the use of curves.

GASOLINE.—George A. Burrell, of the Pittsburgh station of the Federal Bureau of Mines, estimates that in 1909 the consumption of gasoline in this country was 11,000,000 barrels. In 1916 he estimates the amount will be 38,000,000 barrels.

HANDLING CONSTRUCTION EQUIPMENT

The Two Prize Winning Papers Received in the Recent Contest on This Subject

FIVE contributions were received in the contest on the Handling of Construction Equipment in Maintenance of Way Work, which closed March 10. These papers were turned over to C. G. Delo, chief engineer, Chicago Great Western, and W. H. Penfield, assistant to vice-president, Chicago, Milwaukee and St. Paul, who awarded the first prize to F. F. Hanly, assistant engineer, Baltimore & Ohio, Baltimore, Md., and the second prize to S. J. Evans, Central California Traction Company, Sheldon, Cal. The other contributors to this contest included O. W. Duffy, superintendent of construction equipment, Chicago, Burlington & Quincy, Galesburg, Ill.; P. H. Hamilton, St. Louis & San Francisco, Memphis, Tenn., and L. M. Gunstead, supervisor, Illinois Central, Waterloo, Iowa. The two prize winning papers are published below and other contributions will appear in an early issue of this paper.

FIRST PRIZE—THE HANDLING OF EQUIPMENT ON THE BALTIMORE & OHIO

By F. F. Hanly

Assistant Engineer, Baltimore & Ohio, Baltimore, Md.

The character of work coming within the scope of the Maintenance of Way department ordinarily requires the employment of a large complement of special equipment. For the prompt and economical handling of emergencies, improvement work and maintenance renewals, this is indispensable, yet, notwithstanding this, its misdirected use frequently becomes expensive, and the only effective means of governing this expense seems to lie in a well-organized system of centralized control.

An adequate supply of maintenance equipment requires a large capital investment which is justified by the facilities it offers for the prompt handling of emergencies, and since the same equipment is suitable for ordinary maintenance renewals, repairs and improvements, the overhead expense, applied against an individual emergency, is greatly reduced by employing it continuously on such work during the interval between emergencies. Frequently, during certain seasons of the year, demands arise simultaneously on several divisions of a road for the same kind of equipment and the need of it at that time seems so urgent as to warrant procuring new or additional equipment to handle the work properly. This tendency very often leads to an overstock of expensive equipment, most of which must lie idle for several months after the season's work is completed and the overhead must be absorbed in a relatively low output for each machine or car. The fault is not so much the result of the fluctuating nature of maintenance work as it is the lack of a well-regulated system of planning the work for which the equipment is adapted and for directing the work from a central office according to a definite program.

On the Baltimore & Ohio the use of all maintenance of way special equipment comes under the direction and control of the engineer maintenance of way. A program is prepared each year embracing all work over the system for which the various machines are suitable. The equipment is then assigned to the divisions and placed under the supervision and care of the division engineer. As soon as the work at one location is completed and before the equipment is moved, the engineer maintenance of way is notified and his office record of the change in location is revised accordingly. In this way he is informed each day of the location and condition of the equipment, whether in use or idle and the kind of work being done, and the responsibility for its use and maintenance is placed in the hands of the division engineers, whereas its movement from one division to another lies within the direction of the engineer maintenance of way.

The equipment facilities comprise the following:

8	pile drivers.
15	steam shovels.
12	steam ditchers.
14	spreaders.
17	unloading plows.
9	Lidgerwood unloaders.
5	ballast plows.
25	rail unloaders.
2	rail curvers.
3	locomotive cranes.
13	ditching cars.
10	concrete mixers.
10	hoisting engines.
4	air compressors and riveting outfits.
948	camp cars.
6	emergency camp trains.

There are not enough units to distribute one complete outfit to each division, nor is it desirable that such distribution should be made. There are divisions, for instance, which seldom need a pile driver, while others, which suffer from washouts, require them frequently. Relatively few pile drivers will take care of the needs adequately by moving them from place to place as they are required; by keeping a daily record of their location, they will be available for an emergency at any point. Likewise the amount of concrete work is not sufficient to justify assigning a mixer permanently to each division. While such equipment as rail unloaders and camp cars are more or less essential for every-day use, they are usually assigned to all divisions, but the general run of work can be carried on satisfactorily with only a few pieces of each kind of equipment, properly distributed according to the knowledge which a general supervising officer has of all requirements. This practice reduces the amount of lost time from idle equipment to a mini-

mum and insures an equitable distribution to the divisions requiring it most urgently.

The care of all equipment is in charge of the division engineer. The outfits assigned to the division or transferred to it for temporary use are kept clean and in repair by the divisional forces. As soon as the work is completed at one location and before the equipment is removed to another, it is cleaned, repaired and restored in good order. Repairs that cannot be made in the field are handled at the maintenance of way shops at Martinsburg, W. Va., where facilities are provided, not only for making repairs, but for the rebuilding of badly damaged or wornout equipment. The organization for handling the work is large enough to insure prompt repairs so that the equipment is held out of service the minimum length of time. The shop is an important adjunct in the scheme of maintaining a minimum amount of equipment. Since it is operated under the direction of the engineer maintenance of way, he is able to exercise such control over the handling of repairs as to insure the return of the equipment to service promptly.

With the exception of pile drivers, steam ditchers and shovels, no equipment has assigned crews. Regularly employed maintenance of way forces are selected on each division to operate it when assigned or transferred to the division. These employes are otherwise usually engaged in carpenter, bridge, track or tunnel gangs, etc. The pile drivers are in charge of regularly assigned crews who go with the outfits wherever they are used. The complete plant consists of the pile driver, one camp car and one tool car. The crew consists of one foreman, one engineer, one fireman and two helpers to man the leads. This force is augmented by the carpenter force employed on the same work. The pile driver work is scheduled ahead far enough to keep the crew and outfit employed continuously, but a driver is moved from one point to another only when sanctioned by the engineer maintenance of way, except in cases of emergency. The steam shovels likewise have regularly assigned crews. However, as steam shovel work is more or less intermittent, the crews are otherwise employed in the maintenance department during the interval. The regular crew consists of one engineer, one fireman, one craneman and one watchman, but no camp provision is made for these men. Consequently, the equipment is left in charge of a watchmin over night and during interruptions to the work.

The steam ditchers are operated by a hoisting engineer and one helper, who is selected from the division organization to act as fireman. A ditcher is ordinarily used in connection with a work train and under the supervision of a track or extra gang foreman. A sufficient force of labor is employed to load and unload the cars and dress the roadbed behind the machine. An effort is made to train the men operating the various machines so that they are qualified to substitute, in the absence of any member, and ultimately gain promotion in the regular order.

As the season of heaviest maintenance work approaches, it becomes a problem of vital importance to house the additional labor force properly. The work is usually so scattered over the road that the only means of providing adequate, convenient quarters for the extra gangs is the use of camp cars. With nearly 1,000 cars fitted up for camp service, it is imperative that they serve all needs as far as possible and avoid the necessity of diverting more cars from revenue service. It requires their distribution in a way that will avoid overcrowding on one division and part utilization on another. Weekly reports are sent to the engineer maintenance of way from each division showing the total number of cars on hand, their capacity and the number of men occupying them. This makes possible an intelligent comparison of the situation on each division and such readjustments and transfers as seem necessary to accommodate the demands where congestion occurs. Without this control the available equipment would often become inadequate without being fully utilized and create the tendency toward building bunk houses or fitting up other suitable buildings and additional cars at considerable expense.

In addition to the ordinary camp cars, emergency camp trains accommodating from 60 to 70 men are established at six centrally located points over the system. They consist each of four bunk cars, two dining cars, a kitchen car and a foreman's car, and are maintained intact, completely stocked with track tools, bedding, cooking utensils and provisions so as to be available immediately for use at washouts, land slides and other emergencies. They are permitted to be used for emergencies only upon authority of the engineer maintenance of way. Each division on which such a camp is located is responsible for its condition and regular inspections are made by the division engineer to insure that it is being maintained in proper order.

In order that the central office may have an accurate record of the equipment situation at all times, each division makes the following reports on standard forms:

1. Daily report, on pile drivers, steam shovels and ditchers.
2. Weekly report, on all equipment except camp cars.
3. Monthly report, on camp cars.

For the sake of convenient reference by the engineer maintenance of way, the daily reports received from the divisions are abstracted and condensed on separate forms, one for pile drivers, one for steam shovels, and one for steam ditchers. The weekly reports cover all equipment except camp cars. The monthly reports cover camp cars or cars in non-revenue service.

It requires only 7 per cent of one clerk's time to prepare the condensed forms in the central office. When completed they give a concise record of the equipment situation for use of the engineer maintenance of way and serve as an excellent guide in familiarizing him with the progress of the work at all points. The forms contain a complete list of all equipment numbers which serve as a guide for the clerk in checking any failure by the divisions to report.

Summarizing briefly, the salient features in the practice of handling equipment on the Baltimore & Ohio are control by a central office, operation and maintenance by the division organization, equitable distribution to the most urgent work and continuous use, resulting in low unit costs. It is felt that all work is handled more promptly, and the equipment is utilized to greater advantage under this practice than could be attained under any other plan.

SECOND PRIZE—ORGANIZING AND HANDLING CREWS FOR BALLAST WORK

By S. J. Evans
Central California Traction Company, Sheldon, Cal.

After the question of the location of the gravel pit is settled, the steam shovel is the next item that should be given consideration. If the shovel is not new, no matter how little it had been used since it was purchased, it should be given a thorough overhauling at the division shops. This should be done under the supervision of the steam-shovel engineer, as many defects which may be ignored or overlooked by the shop employees will cause serious delays after the shovel has been put into service.

Duplicate shovel parts that receive hard usage, such as

dipper teeth, circle cables, etc., should be furnished and stored in the tool car. As soon as those in service have become worn and must be replaced, others should be forwarded by the supply department upon telegraphic requisition, copies of which should be sent to the roadmaster and superintendent for their files. It should be understood that these "wire" requisitions must not be ignored or held up when they do not conform with the ruling of the supply department. The requisitions should be considered as emergency and should be treated as such, for should the circle cable break a serious delay would result.

All cars which are to go into this service should be taken to the repair shop and overhauled. Particular care should be taken to have the plow cars in good working order. Flat cars if used in connection with Lidgerwood unloaders should be equipped on one end with hinged aprons made of iron or steel plates and it should be understood that when these cars are made up in a train, the aprons must be on the ends of the cars nearest the unloader, so that the plow point cannot lift and tear the aprons from the hinges. The cars should be equipped with steel stakes made of pieces of old rails, a supply of which should be kept on hand at the pit to replace those lost in transit.

Rodger ballast cars should be made tight to avoid leakage of material in transit. The dumping gears should be overhauled and tested to have them working perfectly while dumping with the cars in motion. Side dump cars should be used only to load refuse, such as gravel that contains a large amount of loam or clay. This refuse material is generally used to strengthen embankments and to fill in trestles and can be handled by this class of equipment to good advantage, thus releasing the other classes of ballast cars for the service of ballast distribution.

Hart convertible ballast can be used for side dumping if it is decided that the Lidgerwood must be used, but most roadmasters prefer to have the gravel dumped in the center of the track, so the Hart convertible cars will be considered as center dump cars.

It is essential to select a general foreman who is familiar with every phase of the work. He should be a trackman who has had an extensive experience in handling the unloading and loading of earth, gravel and other material for filling and ballasting. He should have charge of all forces at the pit, including the shovel engineer, pit track foreman, pit engine crew, and car repairers. The shovel engineer should be in direct charge of the shovel. The craneman, fireman and the four, or if the shovel is extra large, six pit men should be placed under his direction. The pit track foreman should be furnished with enough laborers to keep the pit tracks in good condition. These tracks, as a rule, are considered unimportant, as they are temporary tracks, but when consideration is given to the rough usage to which they are subjected, it is clear that these tracks, especially the loading track, must be in good alinement and surface to prevent derailments.

Where the shovel is working but one shift in 24 hrs., a watchman should be provided for the night hours. He should be required, also, to coal up the pit engine and the steam shovel. The coal car should be spotted on the loading track at the rear end of the engine tank and opposite the shovel coal bin and a water tank car should be coupled to the coal car with a hose long enough to reach the water tank of the shovel. A hand or steam pump should be placed either on the shovel tank or on the water car. If the locomotive and shovel are equipped to burn crude oil, instead of coal, the oil car should be fitted with an oil pump stationed on a flat car next to the engine. In fact, both the oil and water pumps could be set up on a flat car and fitted with steam pipes and kept as part of the equipment. This arrangement will enable the watchman to have everything in readiness in the morning for the shovel to begin operation without delay. At noon the water and pump car can be spotted and the water can be pumped into the shovel tank by either the engine or shovel fireman.

Two car repairers should be stationed at the pit to make all light repairs to cars; those that are in such bad order as to occupy these car repairers for too long a time should be tagged and sent to the division repair shops.

It is important to have a telegraph operator stationed at the pit, so that the general foreman can be called upon for any information that is required at the division or district offices. The operator can compile the yard reports, instead of the agent nearest to the pit, as is done when there is no operator at the pit. A train crew should be stationed at the pit and should not be allowed to leave the pit to unload a few cars of gravel out on the main line during the working hours of the shovel. This practice causes delays which result in a diminution of the day's output by the shovel and should not be countenanced by the division superintendent.

One of the duties of the general foreman is to make telegraphic reports each evening to roadmasters and division offices covering the number and class of cars loaded during the day and of empty and loaded cars on hand at the close of the day. He should also make a record of every loaded car that has left the pit storage tracks during the preceding 24 hours. The operator takes a record of the yard at 7 a. m. and the general foreman's report should date from 7 a. m. of the preceding day to 7 a. m. of the date of record. This should be sent to the roadmaster's office, giving in detail the number of cars, and the class, with the initials and car numbers.

As the first requirement at the pit is a loading track, this should be laid in advance of the arrival of the shovel so that the latter can be cut in at once upon its arrival. There should be enough rails and ties on hand to lay a second track immediately behind the shovel. If there is room enough, a switch should be installed in the loading track as close to the main line as possible to allow the shovel to begin loading from this second track, thus avoiding the cutting and the throwing of the pit track to install the shovel, which works off from the short spur behind the frog onto its own track rails.

As the shovel progresses from day to day the pit track gang can lay the second track close behind the shovel. This can be used for the storage of empty cars until the shovel has reached the end of the pit. When the shovel moves back to start a new cut, this track is cleared of empty cars and is in readiness for use as a loading track. The loading track that has just been abandoned may be taken up from time to time as the shovel progresses with the new cut, and laid behind it. This method avoids the delay of half a day or more throwing track each time the shovel is moved back.

No matter how trivial, a report of every delay should be made to the roadmaster, recording the exact time the shovel has been out of service and also giving in full the cause of the delay. By doing this, in every case, it will put the causes of all delays where they rightly belong and will be an incentive for more efficient service.

One point that should be watched very closely is to have all cars loaded to capacity. It is common practice to load light and report the cars as having a full load, thereby making a record for the shovel that is not justified.

Enough storage tracks should be built convenient to the pit to permit empties to be set out and loads picked up without interfering with the pit service. When the train hauls are 75 miles or more in length or extend onto an-

other district or division, a distributing train should be provided to do the unloading.

Where the gravel runs freely, a foreman and four laborers will be sufficient to handle the unloading of the ballast. If the cars are of the Hart convertible type, two men should be worked upon the ground. One uses a piece of iron pipe about four feet in length as an extension for the dumping lever and holds the bottom doors closed when the other man releases the latches. By the use of this extension of the levers the doors are kept from flying open and covering both rails with gravel, thereby derailing one or more cars. The other two men should be stationed, one on each end of the car, working the gravel out of the corners with a shovel. This gang should be kept continuously in this service throughout the season and should be recruited from the track forces, selecting those who are seeking advancement and are willing to work for it. Additional help, when needed, should be given by the foreman of the section upon which the gravel is being unloaded.

Upon some railroads, the unloading is done under the supervision of the conductor of the train, who is given section men to do the dumping. This system is radically wrong, for in no place is a foreman of keen insight or judgment needed more than in charge of the distribution of ballast material.

The arrangement of cars for greater safety as well as economy is important. Where Hart convertible cars are in use as center dump cars, the dumping is handled from the ground and these cars should be switched or turned to have the dumping levers all on one side of the train, preferably on the side of the prevailing winds. This places the lever men and brakemen out of the dust and in a clear position to give signals. The engineman should be on the same side also. It makes little difference whether the engine is backing up or going forward, but the instant of time required for the fireman to relay a signal cannot always be spared in case of an accident.

THE SOUTHERN FOREST SITUATION

THE United States Department of Agriculture has issued bulletin No. 364, entitled, "Forest Conservation for States in the Southern Pine Region," by J. Girvin Peters, chief of state co-operation. This bulletin points out the situation which arises from the removal of the pine and hard wood forests without proper provision for restocking the cutover areas or the prevention of fires. One result has been an increase in the erosion of streams, the silting up of channels in the lower reaches, with much damage by floods.

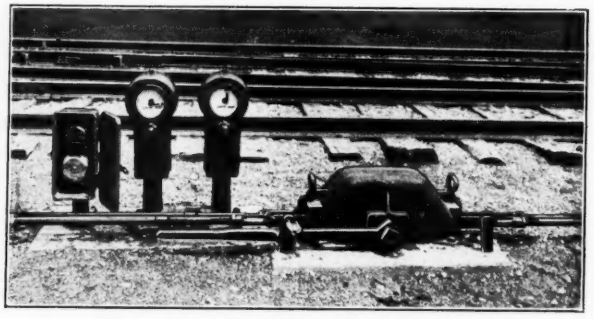
The solution suggested is adequate forest legislation by the individual states to secure a non-partisan department of forestry, a technically trained forester in charge, a forest fire protective system, co-operation with private owners and towns in the management of timber lands and for tree planting, state-owned forests by gift or purchase and an adequate appropriation of funds. It is also suggested that the individual states investigate the state-owned lands with a view to withdrawing from sale those chiefly valuable for timber production.

Special attention is drawn to the importance of the lumber industry to the southern states, with an annual cut having an estimated value of about $275,000,000. At the present rate of cutting the existing stand of timber is estimated to last 35 years.

STANDARD CROSSING SIGNAL.—The American Railway Association has adopted a circular disc with the word "STOP" painted thereon as the standard signal for highway crossings, and will take steps to secure its adoption.

THE SAFE LOCK SWITCH MACHINE

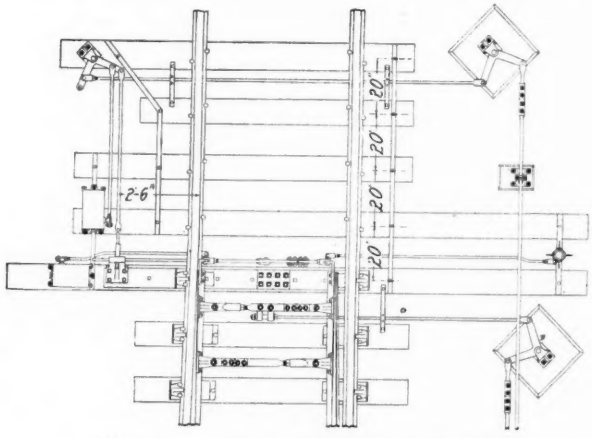
THE simultaneous throwing of both switches of a crossover removes the possibility of trainmen, or others, setting one of the switches for movement through the crossover, while the other is set for the straight track. Furthermore, with this method, the chance of having a light engine on a crossover with one or both the switches set for a conflicting movement is remote as the occasion



THE INDICATORS

for such handling on the part of trainmen is removed. The desirability of having both switches of a crossover open before a train starts to make a crossover movement and the movement completed before either switch is restored to its normal position is obvious. The Safe Lock switch machine has been designed in an effort to fulfill these conditions in a safe and practical method, while at the same time facilitating the work of the trainmen.

One of the first steps in this development was to locate a switch and lock movement at one switch and connect it by a single pipe line to the throwing stand at the other switch. This method was found unsatisfactory because sufficient stroke is not provided by the ordinary switch stand to operate a switch and lock movement in a reliable manner, and the throwing lever could be forced into place with little extra effort without the switch-and-

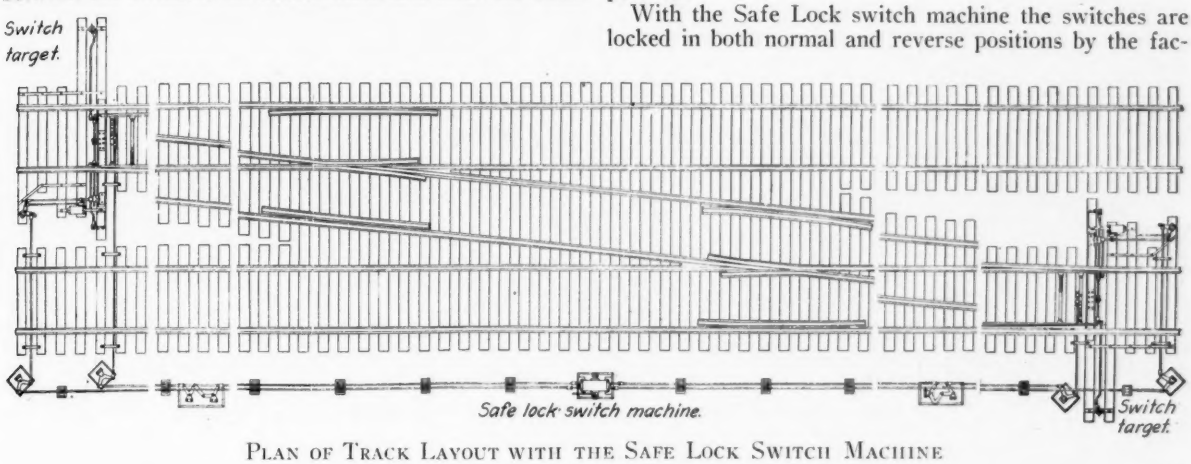


CONNECTIONS AT THE SWITCH POINT

lock movement completing its stroke and locking the switch, and without the condition being detected by the switchman. Another method was to connect the switches together directly by cranks, leaving out the switch-and-lock movement. This also proved undesirable for the reason that the points of the pipe-operated switch could be held open to a dangerous extent by an obstruction, and the condition not be discovered by the switchman.

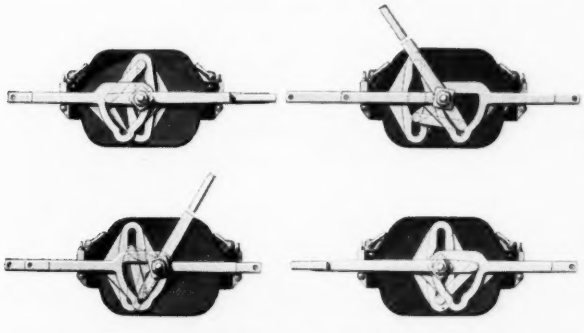
These experiments demonstrated that there were two

essential points to be covered before the throwing of both switches from one stand simultaneously could be accomplished in a practical and satisfactory way; first, sufficient stroke must be secured at the throwing stand to operate a switch removed a distance equal to the length of an ordinary crossover; and, second, reliable means must be provided whereby a switchman could be sure that the switch points of both switches had moved into place. The two-lever ground stand, located midway between the switches on double-track and near the main track switch on single-track, partially covered these requirements. In this scheme both the switches are equipped with standard interlocking connections and facing point locks; the switches being operated by one of the levers and locked in the normal position by the facing point locks operated by the other lever.



PLAN OF TRACK LAYOUT WITH THE SAFE LOCK SWITCH MACHINE

The first installation of this kind was made on the Cincinnati, New Orleans & Texas Pacific on April 4, 1911, and several similar installations have been made since. They are still in service and have given little, if any, trouble from adjustments, renewals, etc., but several objections to the arrangement have arisen. First, the switches are only locked in the normal position by the facing point locks. Second, it is more or less confusing to trainmen to have to operate two levers, and in a few instances they have left the switches in the normal position and unlocked, failing to restore the lock lever to its normal position. Third, if the points are not properly in place for the crossover movement, no reliable means is provided for a switchman to detect this condition.



THE FOUR POSITIONS OF THE LEVER

It was to overcome these objections that the Safe Lock switch machine was designed. The switches are equipped with standard facing point locks, the connections being installed in accordance with standard interlocking specifications. The Safe Lock switch machine is placed midway of the crossover on double track and at the main track switch on single track. Only one lever is required, thus removing the objection of confusing trainmen, or the necessity of special training on their part to properly operate the stand. The first movement of the lever through 60 deg. unlocks the switches; the movement through the next 60 deg. throws them, and the movement through the last 60 deg. locks them in the new position.

With the Safe Lock switch machine the switches are locked in both normal and reverse positions by the facing point locks, and failure of either of the switches to go to its proper place in either position is indicated to the switchman in an unmistakable way, as he would have to buckle the lock operating connections a distance of five inches to get the lever down on either side. He can tell readily if the points have responded to the lever by looking at the targets on the switches; the facing point locks then insure the points fitting up.

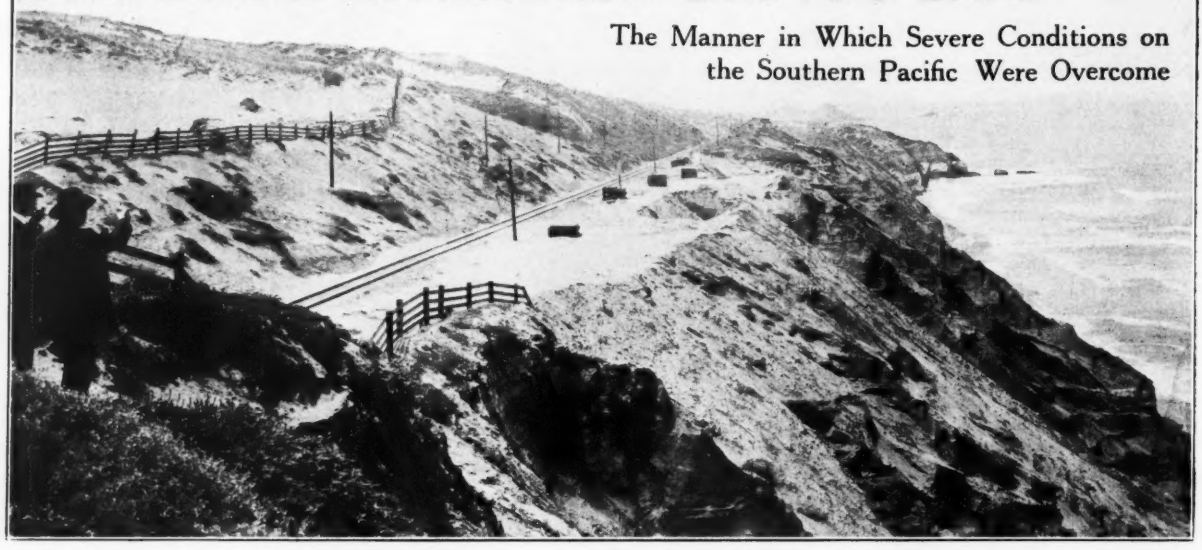
In designing the machine, strength and simplicity of parts have been given particular attention. The weight of the machine is approximately 400 lb., and there are only three operating parts exclusive of the lever and two operating pins and rollers. Mounted on a concrete foundation, it is rigid and positive in operation. A stroke of 6¼ in. is provided for throwing the switches.

The first Safe Lock switch machine was installed on the Cincinnati, New Orleans & Texas Pacific on March 22, 1913, and it is reported to have given excellent service with no repairs, and with only ordinary attention, since that time. After the first installation had been in service about one year the use of this device was extended gradually over all the districts on the Cincinnati, New Orleans & Texas Pacific and Alabama Great Southern with uniformly good results. At present there are 50 crossovers equipped with the facing point lock layouts, 12 being operated by two-lever ground stands and 38 by Safe Lock switch machines. These machines are being placed on the market by Chas. F. Jones, Lexington, Ky.

EUROPEAN TIMBER-TREATING PLANTS.—All the Belgian plants were taken over by the Germans. There are about six plants which were owned partly by private and partly by government interests. In times of peace the government plants were managed by the German authorities. One of the largest creosoting plants in northeastern France is that of Amagne, which was captured by the Germans. The 150,000 ties found in this plant have been used by German troops for repair and other work, and the plant is not now in operation. Serbia had one small plant at Chichewash, near Nish, and it is now being used as a magazine for the German troops.

PROTECTING TRACK FROM DRIFTING SAND

The Manner in Which Severe Conditions on the Southern Pacific Were Overcome



Southern Pacific Track Along the Pacific Ocean Near Surf, Cal.

FOR a considerable distance north of Santa Barbara, Cal., the Coast division of the Southern Pacific lies immediately adjacent to the Pacific ocean. The track is located on a bench considerably above the elevation of the water and passes through a considerable area of sand dunes. This sand is continually drifting back and forth, moving at times seaward and again shoreward. These conditions were particularly serious between Surf, Cal., and Honda, a distance of five miles. In many places between these points the track is located only a stone's throw from the ocean, lying from 150 to 186 ft. above the water, with the sand dunes rising 100 ft. to 200 ft. higher.

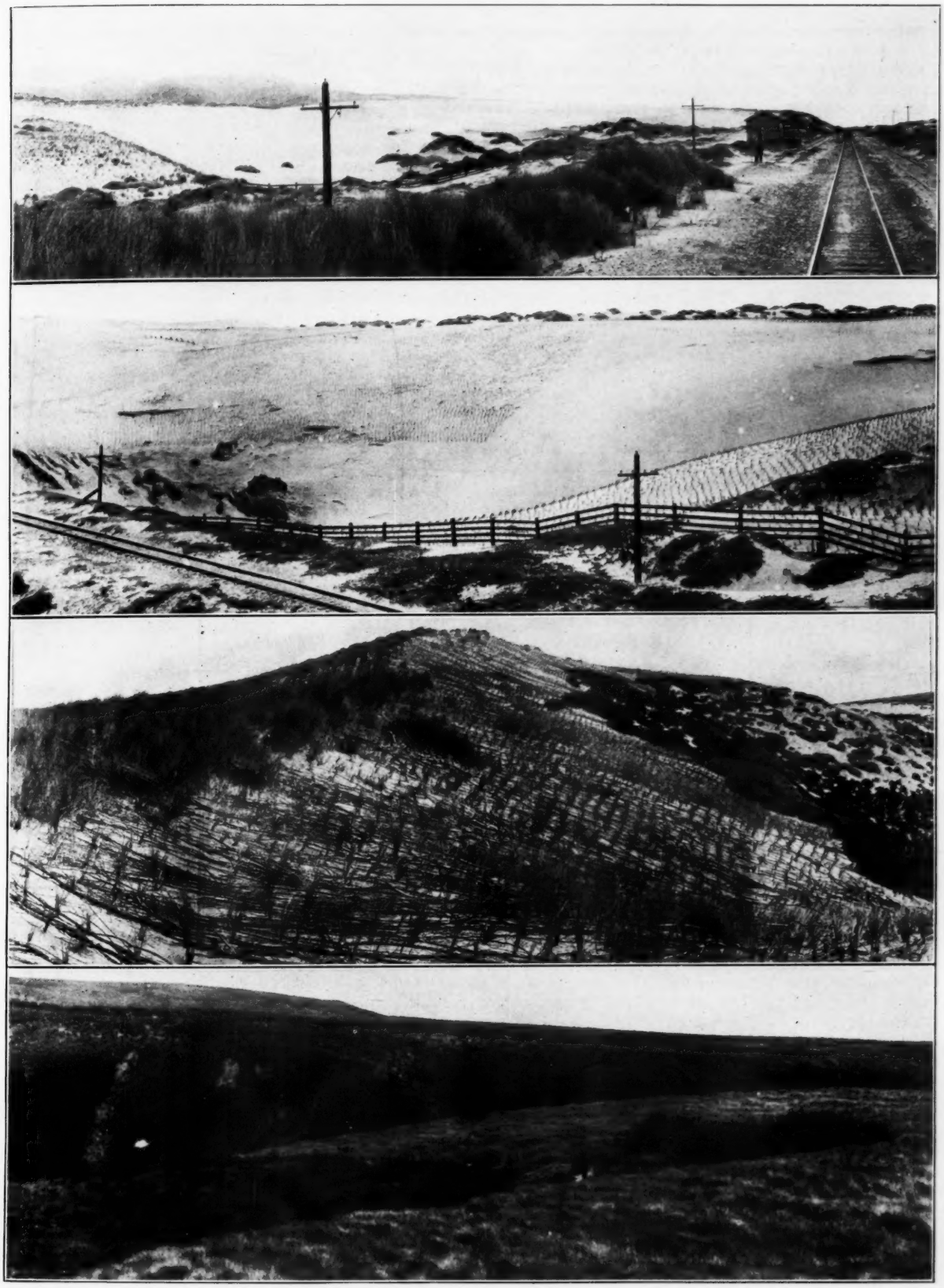
These conditions created serious elements of danger for train operation. Although watchmen were employed to patrol the track constantly this protection was subject to two serious dangers. While the wind might not appear excessive at the points where the employees happened to be, sand might be drifting badly at other points nearby. Strangely enough such storms are the most dangerous, as the sand does not then fill the air to warn those who approach of its presence, but moves along close to the ground and frequently covers the rail on one side of the track only. This is sufficient, however, to derail a locomotive or car coming upon it. Also, watchmen assigned to the patroling of the track to detect drifting sand become very unreliable after long periods of immunity, and frequently do not detect a local flurry covering the rails during a couple of hours' inattention or during the night.

It was, therefore, necessary to adopt some permanent means of relief. About 1898 sand fences were established, but these were soon discarded, as it was found that they had the tendency to build the hills up to an even greater height. The experiment was also tried of spreading large quantities of adobe over the surface of the sand adjacent to the track. Extensive experiments were conducted with the planting of native grasses and weeds, but it was found that the plants failed or died for lack of nutrition. While certain weeds came up well, the sand blasts cut and destroyed the tender growth and no progress was made along these lines.

The peach apple, or mesembryantheum, flourishes and abounds at points a few miles from this vicinity. It was therefore quite natural that much should be expected of this plant, but as it was short and in the nature of a carpet, and as the carpet was not complete, but lying more or less loosely, after being transplanted it was uprooted and entirely destroyed by severe storms before becoming set.

In the spring of 1908 about 1,000 plants of the species of grass called bent grass (Amophila Arenaria), used in reclaiming sand dunes at the Cliff House and in Golden Gate Park, San Francisco, were sent for planting in the Honda dunes. An exposed and prominent site was chosen for this experiment, and such good results were obtained that future efforts were confined for three years to extending its growth over the entire area, selecting the most troublesome spots first. As the plants had to be obtained in San Francisco and hauled from the park to the depot the day after digging, shipped 300 miles to the nearest station and then hauled by push car to the site of the planting, a considerable loss at first resulted, over 25 per cent of the grass failing. In three years, however, a sufficiently heavy stand developed so that the plants were obtained from the first and second year's planting. Of these no loss occurred from failure to take hold and throw out roots, the only loss being on exposed slopes during exceptionally heavy storms, where the wind cut in and uprooted small patches here and there to an amount not exceeding 2 per cent. The expense of handling the reclamation also decreased greatly when plants were obtained from fields adjacent to the work, the cost of planting per acre with grass from Golden Gate Park, San Francisco, being $49.56, as compared with $26.45 per acre at present. On one hill, where in times past the sand covered the rail to the depth of from 5 to 30 ft., no trouble has occurred for five severe seasons. Steam shovel and hand work and watchmen amounted each year to many times the cost of planting this area of 40 acres and safety is now assured.

The method of handling this reclamation is as follows: A gang of 30 men moves on the ground as soon as sufficient rain has fallen to moisten the sand on top and pulls



Conditions Before Work was Undertaken
Planting in Progress, with an Unplanted Area in the Center
A Closer View of the Method of Planting
An Area on Which the Grass Has Grown

the grass from thrifty tufts in an established field. The grass pulled is 24 in. to 30 in. long and the tops are cut off, reducing the length to 18 in. It is done up in handy bundles, bound with grass, and transported to the point of planting. The grass is planted in rows spaced two feet apart, and the plants are placed at intervals of two feet in the rows. When placing them in the ground a vertical opening is made in the sand with a shovel and a plant is dropped into the opening before withdrawing the shovel. After the shovel is withdrawn, the foot is pressed on the side of the opening from which the shovel came to close the sand firmly about the roots.

A field completely planted in this manner presents to the wind a broom of grass eight to ten inches high and so breaks and interferes with it that only in rare cases, as on steep slopes, does it obtain a hold upon the sand sufficient to raise it. The dry broom left standing above the sand protects the field until the roots are formed and green shoots appear of sufficient strength to withstand the wind.

Among the grass may be planted seeds of the Blue Lupin, which in time becomes a strong brush. The grass protects these, and all other young tender shoots, which will thrive under such protection in the sand. The Acacia Latifolio flourishes in the sand and may be planted at intervals of 12 ft. in rows 12 ft. apart, becoming a dense thicket in three years. The coast division of the Southern Pacific now has 140 acres planted to bent grass with ten acres of it reinforced with acacia and lupin.

As an experiment 200 young African Cedar trees are being grown from cuttings obtained near Keeler on the Sale Lake division, in 1913. The nursery at Goleta, Cal., also propagates pine, cypress and gum trees that are planted in the reclaimed area; 20,000 acacias, 200 pines, 700 cypress and 1,000 gum trees have been planted, of which all but the pine are doing well.

We are indebted to W. R. Scott, vice-president and general manager of the Southern Pacific, for the above information.

ENLARGING A DEEP WELL

THE capacity of a deep well on the Chicago, Milwaukee & St. Paul was doubled recently by reaming out the upper 255 ft. to permit the use of a larger pump pipe and cylinder. The experience with this well included also a number of other interesting features.

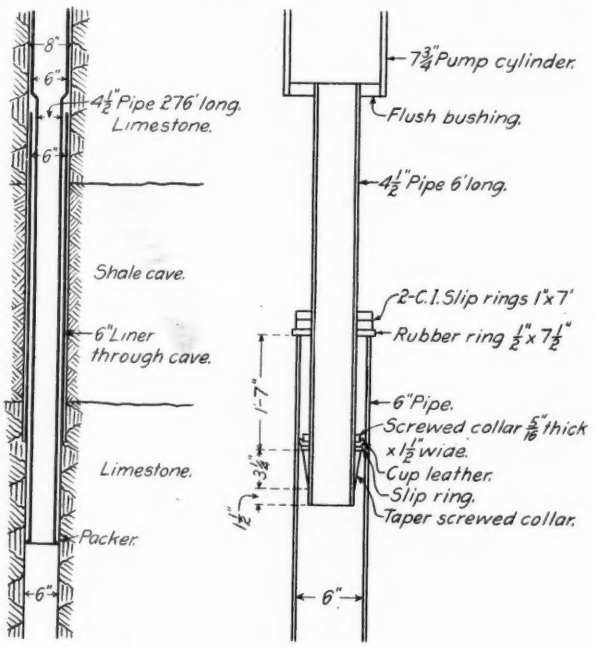
The well is located at Mannheim, Ill., and was drilled in 1911. Commencing at the top, it consists of a 55-ft. drift cased with 12-in. pipe, 926 ft. of 8-in. hole and 842 ft. of 6-in. hole. It was the intention to drill an 8-in. hole for the full depth, but when the drilling had reached a depth of 981 ft., a stratum of shale a short distance above commenced to cave, making it necessary to insert a section of 6-in. casing for the entire depth of the stratum of shale and one of lime stone just below it, which was full of crevices. The rest of the well obviously had to be drilled with a 6-in. bit.

Water was encountered in quantity in several strata, but it was all too hard for use in boilers except that obtained from a 108-ft. stratum of white sand at the bottom of the well. To exclude all the other water it was necessary to case the well to the depth of the lowest of the other water-bearing strata, which being in the 6-in. portion of the well necessitated the use of 288 ft. of 4½-in. pipe at the lower end of the casing, with 908 ft. of 6-in. casing above it.

The well was equipped with an air lift consisting of 321 ft. of air pipe in 338 ft. of 4-in. discharge pipe. Air was supplied by a 10-in. by 10-in. air compressor, belt driven by a 40 h.p. Nash gas engine. A pressure of 121 lb. per sq. in. was necessary to start the water and the normal pressure while the water was running was 97 lb. A discharge of 110 gal. per min. was developed with this equipment, requiring the consumption of 5 gal. of gasoline per hour.

The air lift plant was later replaced by a Downey double-acting deep-well pump, furnished by the Keystone Driller Company, Beaver Falls, Pa., belt driven by a Stover fuel oil engine. The pump cylinder was 4¾ in. in diameter placed 150 ft. below the surface. This pump delivered 100 gal. per min. with a consumption of fuel (kerosene) of 1¼ gal. per hr., a great saving over the previous arrangement.

Since the well was installed there has been a gradual increase in the consumption of water at this station, leading about the first of this year to a study for increasing the capacity of the plant. In view of the location of the water-bearing strata at the bottom of the well and the relatively small drop in head, accompanying a discharge



SKETCH SHOWING METHOD OF ENLARGING WELL

of 100 gal. per min., it was concluded that the capacity of the well was sufficient to supply water for a material increase in the pumping capacity, which was limited under the circumstances to the discharge obtainable with a 4¾-in. pump cylinder.

Accordingly, it was decided to increase the diameter of the well for a sufficient depth to permit the installation of a larger pump cylinder and a contract was let for enlarging the well to a 12-in. diameter for a depth of 255 ft. The 6-in. casing was cut off at that depth and pulled. The end of the pipe was then plugged temporarily and the 8-in. hole was reamed out to a diameter of 12 in. as far as the end of the 6-in. pipe.

It was the intention to line this 12-in. hole with a 10-in. casing, but it was found that the reaming tools used by the contractor formed a hole that was so crooked that it was impossible to lower more than a relatively short length of 10-in. pipe into it without binding. In consequence it was necessary to use an 8-in. pipe and instead of sealing the connection with the 6-in. pipe by putting the new pipe over the one already in position, it

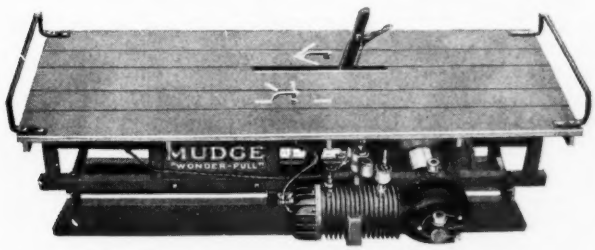
was necessary to make the connection with the 6-in. pipe by means of a 6-ft. length of 4½-in. pipe as shown in the accompanying drawing. This detail was devised by A. D. Beesley, chief carpenter.

The upper end of the 4½-in. pipe was connected by means of a flush, threaded bushing to the working barrel of a deep-well pump, which was in turn connected to the 8-in. pipe which served as the discharge line. The new pump is of the same type as the one which it replaced, except that it has a 7¾-in. cylinder. It is belt operated by a Fairbanks, Morse type "Y" crude oil engine of 20 hp. operating at 350 r.p.m. This plant on test discharged 200 gal. of water per minute on 7 qt. of kerosene and ¼ pt. of lubricating oil per hour. This fuel consumption is considerably more than double that for the discharge of 100 gal. per min. with the same type of pump, and is accounted for, partly by the increased friction resulting from the higher velocity through the two sections of 4½-in. pipe, which circumstances made it necessary to install in the well and also by the greater drop in head required to obtain the greater discharge from the well.

The contract price for increasing the size of the well for the depth of 255 ft. was $1,200. The increased capacity has been found of material advantage. All the water necessary can be pumped each day in an average of 18 hrs. Formerly the pump was in practically continuous operation and there were runs of 140 to 192 hrs. without stops. The alterations to the well were carried on under the direction of A. Yappen, district carpenter, Chicago, Milwaukee & St. Paul, Chicago, Ill.

A HAND-CAR ENGINE OUTFIT

AS a means of holding men and securing more efficient work, many section foremen have equipped their old hand cars for gas engine propulsion at their own expense rather than wait until the railroad company could furnish them with new motor cars. These engines are ordinarily installed on the cars by the section foremen themselves, who provide the necessary housing, seats, etc. In order to reduce this work to the simplest possible form, Mudge & Co., Chicago, have introduced a motor engine outfit complete in a single unit. The frame which supports the engine serves also as a seat for the crew



THE ENGINE OUTFIT READY TO INSTALL

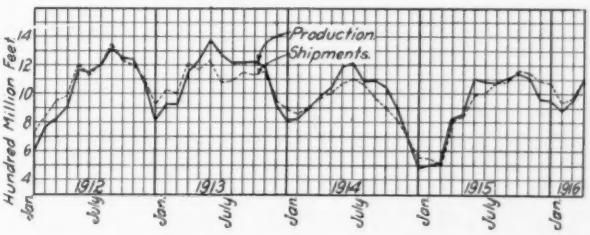
and houses the battery box as well. Everything is completely assembled, ready to run, except for the transmission to the car axle. The work of installing it on the car is a simple matter. The frame is bolted to the floor of the car, a hole is cut in the floor for the passage of the drive belt and a split steel pulley is attached to one of the car axles.

The engine has a horizontal cylinder of 4½-in. bore by 5-in. stroke and develops six horsepower at 600 r. p. m. A special effort has been made to insure simplicity and the use of a minimum number of parts. This is true also of the carburetor, which is automatic with but a single adjustment. The engine may be equipped also to burn either kerosene or gasoline, with provision for the use of gasoline to start the engine.

Lubrication is provided by mixing lubricating oil with the kerosene or gasoline, by means of a sight feed lubricator on the cylinder and grease cups on the crank shaft bearings. The seat is 25 in. by 68 in. and the complete frame with all parts in place weighs 300 lb.

LUMBER STATISTICS FOR 1915

THE Forest Service of the United States estimates that 37,013,294,000 board feet of lumber was cut in 1915, by 29,941 mills. These figures are based on a total of 30,985,473,000 board feet reported by 16,248 mills. The following tables give the total cuts by states and also the total production of the various kinds of the principal woods as far as the figures are available to date. The cut for yellow pine is the largest, being 14,-



CURVE OF LUMBER PRODUCTION AND SHIPMENTS

700,000,000 board feet, and that for Douglas fir comes next with 4,413,000,000 board feet.

Since the beginning of February there has been a marked increase in both the shipment and production of lumber in this country. In March, 1916, 951,800,000 feet were cut, as compared with 797,500,000 in March, 1915, and 899,100,000 were shipped in March, 1916, as compared with 748,500,000 in the same month in 1915.

1915 PRODUCTION OF YELLOW PINE

State	Number of Mills Reporting	Production of Mills Reporting M Ft.	Estimated Total No. Active Mills	Estimated Total Production M Ft.
Louisiana	201	2,868,402	300	2,950,000
Mississippi	460	1,630,354	975	1,850,000
Texas	229	1,544,210	350	1,650,000
North Carolina	1,024	1,078,077	2,500	1,700,000
Alabama	557	1,004,499	1,250	1,350,000
Arkansas	350	1,067,853	600	1,190,000
Florida	181	823,270	360	950,000
Virginia	832	493,332	1,650	1,000,000
Georgia	481	523,498	1,400	890,000
South Carolina	356	565,910	750	750,000
Oklahoma	42	160,406	90	170,000
Reported total	4,713	11,759,811		
Other States			1,555	250,000
Estimated total			11,780	14,700,000

1915 PRODUCTION OF DOUGLAS FIR

State	Production of Mills Reporting M Ft.	Estimated Total Production M Ft.
Washington	2,754,179	2,920,747
Oregon	1,119,395	1,254,125
California	117,951	119,000
Idaho	76,283	76,700
Montana	41,464	42,400
	4,109,272	4,412,972

PRELIMINARY 1915 FIGURES FOR OTHER WOODS

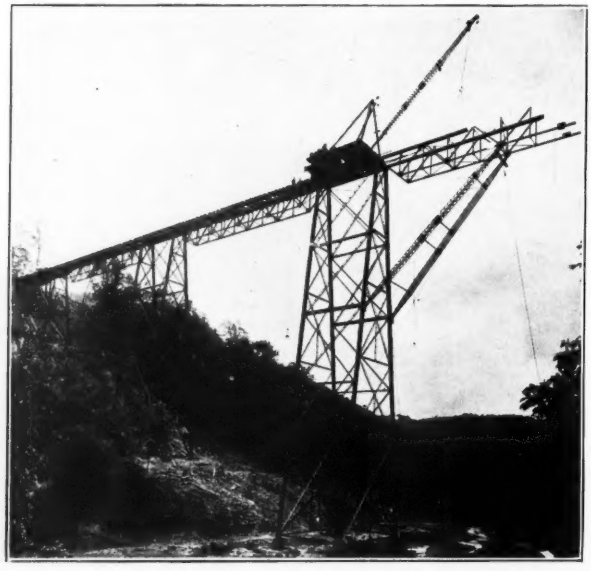
Hemlock		**White Pine**	
Wisconsin	446,584 M	Minnesota	884,252 M
Michigan	362,973 M	Idaho	201,858 M
Washington	306,570 M	Wisconsin	188,274 M
Pennsylvania	256,170 M		1,374,126 M
West Virginia	132,346 M	**Western Pine**	
New York	93,014 M	Calif. and Nevada	389,991 M
Maine	68,631 M	Idaho	301,600 M
Oregon	61,963 M	Oregon	189,203 M
	1,728,251 M	Washington	130,507 M
Cypress		Montana	118,920 M
Louisiana	559,830 M	Arizona	75,843 M
Florida	147,079 M	New Mexico	61,466 M
Georgia	47,261 M		1,167,788 M
South Carolina	30,034 M	**Redwood**	
Arkansas	24,554 M	California	418,824 M
Mississippi	23,679 M	**Sugar Pine**	
Missouri	23,639 M	California	114,494 M
	856,076 M		

A NOVEL ERECTION METHOD

BY H. S. COWELL

Erection Engineer, Virginia Bridge and Iron Company, Roanoke, Va.

A HIGH steel viaduct was recently completed for the transportation of coal mine cars in Wyoming County, West Virginia, which presented some unusual features in erection. The United Pocahontas Coal Company arranged to lease 1,200 acres of No. 3 Pocahontas seam coal in a mountain situated on the north side of Pinnacle creek and to the north of the present mines of the Zenith and Indian Ridge coal companies, but to reach this new



ERECTION VIEW, SHOWING THE STEEL STRUTS

field and transport the coal to the tipples of the old coal mines, it was necessary to extend one of the present Zenith drifts northward to the face of the mountain and then bridge the valley. Owing to the inaccessibility of the proposed viaduct all of the members for it had to be hauled on mine cars about one mile through the old drift, which was in some places only four feet high in the clear and with frequent sharp curves, and this was a governing factor in the design.

The design adopted provided a viaduct 680 ft. long and about 170 ft. high in the center, made up of one 30-ft. beam span, four 102-ft. spans, and one 92-ft. riveted deck truss span, supported on five towers of 30-ft. span, and weighing about 340 tons. As the erection equipment had to be brought to the bridge site through the old mine, and as the pieces to be handled were comparatively light and short, it was decided to use a light timber traveler. This necessitated the use of a scheme of erection whereby the truss spans could be erected one piece at a time. As the cost of falsework for this would be very high, a pair of inclined steel struts or booms were made, the lower ends of which were pin connected to temporary wing plates bolted to the columns and the top ends of which were held in position to receive the bottom chords of the truss span by two 1¼-in. diameter wire rope cables. These cables were fastened to turn buckles with a 24-in. takeup, which were in turn fastened to the head of the second column back with heavy chains.

After the erection struts were in place the truss span was built up on them to a point a little beyond the center, after which the traveler was moved forward to the center of the span and the next tower was built up, followed by the remainder of the span. The traveler was then backed off the span and was used to remove the erection struts, transferring them ahead to the completed tower and placing them in position for the next span. These struts were made long enough to give the proper camber to the truss span and no difficulty whatever was encountered in placing the last sections of the top chord.

The actual time of erection was 34 working days with an average of 34 men. The steel for this viaduct was designed, fabricated and erected by the Virginia Bridge and Iron Company, Roanoke, Va.

RECENT DERAILMENTS

ON February 2, passenger train No. 44 of the Pennsylvania R. R. was derailed near Seward, Pa., while running at 65 miles per hour, five of its eight cars being derailed, and 44 passengers and 3 employees being slightly injured. The derailment was caused by the weakening of the track, following the removal of the spikes from two out of every three ties for a distance of 1,000 ft., preparatory to the renewal of rails. The foreman in charge of the track work was a man of 13 years' experience.

An extra train consisting of an engine and two cars was derailed on the Coal & Coke Ry. near Milliken, W. Va., on February 7, overturning the tender and injuring one trainman. The derailment was caused by weakened track following a heavy rain.

Louisville & Nashville train No. 94 was derailed at Henderson, Ky., on March 3, by frozen mud in the flangeway at a public crossing, killing the fireman.

A southbound passenger train broke through a bridge on the South Dakota Central near Watertown, S. D., killing 2 passengers and injuring 13. The bridge had been weakened by a fire, believed to have been set by a preceding train.

A work train was derailed on the Central of New Jersey near Edison, N. J., on March 10, by snow in the flangeway of a highway crossing, killing the engineer.

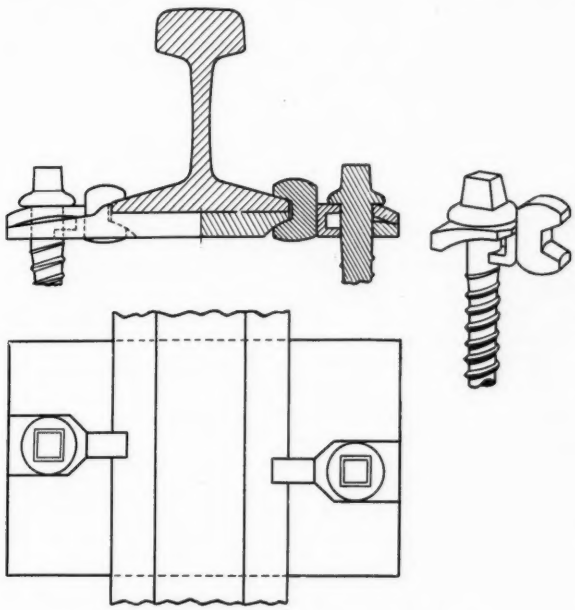
The "Katy Flyer" of the Missouri, Kansas & Texas was derailed near Itasca, Tex., on March 20, 3 cars leaving the track, and 5 passengers being slightly injured. The cause of the derailment was weakened track at a point where rails were being renewed.

An engineer was killed and a fireman seriously scalded in the derailment of a Baltimore & Ohio passenger train at Flora, Ill., the locomotive being overturned and three coaches leaving the track. The derailment was caused by weakened track at a point where repairs were being made.

A NEW TRACK FASTENING

A TRACK fastening that will maintain a resilient but firm contact between the parts it joins together under service conditions is greatly to be desired. Such a fastening will reduce to a minimum the wear between parts, especially of the tie plate into the tie, and so reduce one of the largest of maintenance expenses. The fastening here described has been designed with a view to providing a practical means of maintaining this principle.

By reference to the accompanying drawing it will be observed that the rail is held to the tie plate by clamps. These clamps have inclined fingers which permit of a strong clamping effect and also, by reason of their inclined fingers, adjust themselves to any ordinary imperfections of commercially rolled rails and tie plates. Back of the clamps and engaging them and the screw spikes are steel springs so shaped that they drop freely into place before the screw spikes are inserted. As the screws are turned down these springs flatten out and, by an action similar to that of a toggle joint, press the clamps securely into place. These springs have a range of adjustment sufficient to compensate for any ordinary irregularities in the other parts. The upper portions of the springs also act as spring washers between the screw spike heads and the tie plate. The tie plate is similar to the ordinary shoulder plate except that inclined grooves are formed in its under side to receive the lower fingers of the clamps. The screw spikes are the same as those used with rail clips. Bolts through the tie or driven spikes may be used instead of the screw spikes if desired.



PLAN AND SECTION OF THE FASTENING

Six of these fastenings have been tried out experimentally for a period of one year in a track laid with 100-lb. A. R. A. type A rail, carrying about 10,000,000 tons annually. They were applied to ties which had been previously adzed down considerably on account of wear under 7½-in. by 10½-in. by ⅝-in. plates and ordinary driven spikes. The ties have not shown any further wear during the period of the experiment.

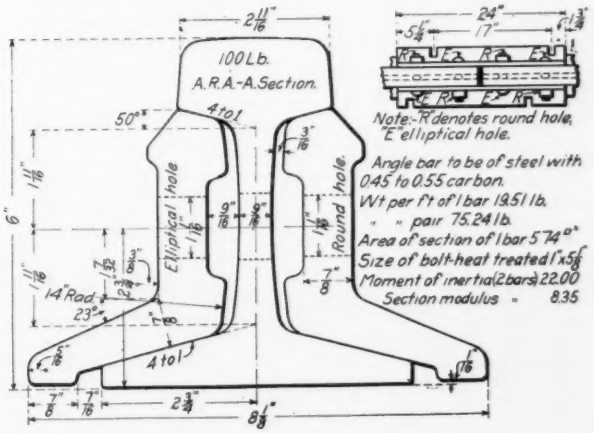
The main advantage to be expected of the fastening is due to the principle first mentioned of maintaining an unbroken resilient contact between the parts, but in addition to the resulting reduction in the wear of the tie plate into the tie, the fastening, by maintaining an unbroken contact between the parts, will reduce rail creeping. The rail and tie plate are clamped together, making the tie plate in effect a part of the rail and providing a broad base, which adds to the stability of the rail against overturning.

The full holding power of the screw spikes, bolts or driven spikes is developed by reason of the upward thrust from the rail being delivered on at least the two opposite sides of their heads. Also as this force must be transmitted through the springs, no sudden blow can result. This device has been patented by H. E. Van Ness, assistant engineer, Central Railroad of New Jersey, New York, N. Y.

NEW ROCK ISLAND ANGLE BAR

BY J. G. WISHART
Office Engineer, Rock Island Lines, Chicago

THE accompanying design of angle bar is one which will be used with new 100-lb. A. R. A. type A section open hearth steel rails on the Rock Island Lines during the coming summer. A similar section has been prepared for 90-lb. rails. These sections were designed in the chief engineer's office under the direction of C. A. Morse, chief engineer, and are modifications of sections used in preceding years. These modifications consist mainly in the design of a larger head or upper flange and a thicker web. Metal has been added in the head by increasing its thickness on the inner face and adding the longitudinal ridge on the outer face above the bolt holes, this ridge being designed for the use of ¼-in. spring washers. In addition to giving added strength to the bar, the heavy upper flange and thick web have a moral effect on the trackman in that they show their strength and thus appeal to his natural instinct. This is considered a benefit as it will impress him with its effectiveness and gain his attention in seeing that it is properly applied.


100 Lb.
A.R.A.-A. Section.
Elliptical hole
Round hole
Note:-'R' denotes round hole,
'E' elliptical hole.
Angle bar to be of steel with
0.45 to 0.55 carbon.
Wt per ft of 1 bar 19.51 lb.
" " pair 75.24 lb.
Area of section of 1 bar 5.74 sq"
Size of bolt-heat treated 1"x⅝"
Moment of inertia (2 bars) 22.00
Section modulus = 8.35

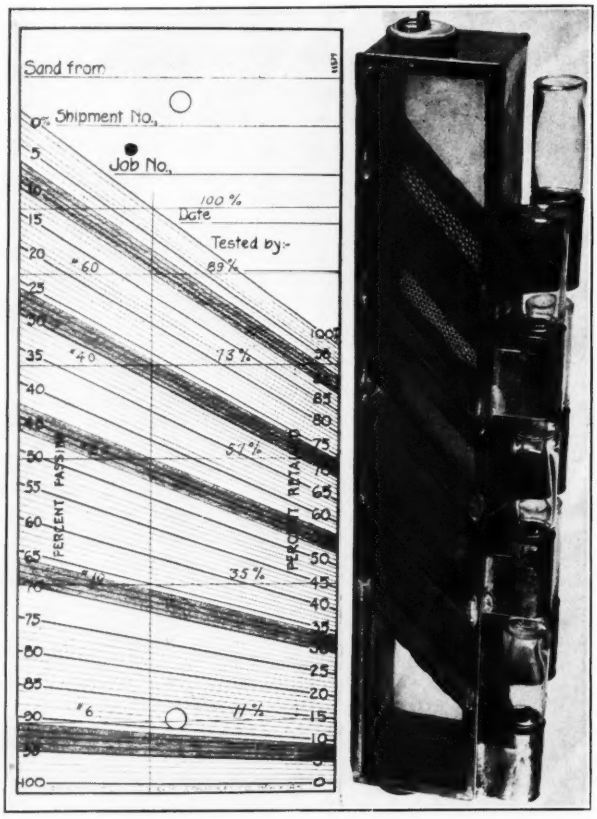
THE NEW ROCK ISLAND ANGLE BAR

These bars are heat-treated and quenched in oil and are of steel with 0.42 to 0.55 carbon. They will be applied with 1-in. heat-treated track bolts and spring washers. Rock Island standard tie plates and ⅝-in. by 6-in. track spikes, instead of the ordinary 9-16-in. by 5½-in. spikes will be placed on all joint ties.

A UNIVERSAL SAND TESTER*

BY CLOYD M. CHAPMAN
Engineer of Tests, Westinghouse Church Kerr & Co., New York, N. Y.

ANY method which will determine quickly and with reasonable accuracy whether the granularmetric analyses of the sand shipments received agree with the analysis of the sample tested when the suitability of the sand was determined, will serve to check the quality of the sand as it is used on the job. A method which seems to solve the problem and to provide a quick, easy, accurate record of the size analysis of sand without requiring an expert operator or laboratory equipment is by means of a sand tester recently put on the market for this particular purpose. This consists of a box of sheet copper in which



SAND TESTER AND SAMPLE RECORD SHEET

are soldered a series of wire screens placed at an angle of about 45 deg. with the narrow sides of the box. The accompanying photograph shows one of these instruments constructed with glass sides to show the internal arrangement of screens.

There are five of these screens which divide the box into six compartments. Each of these compartments opens into a chamber attached to one side of the box and into each of these side chambers is screwed a glass cylindrical measuring receptacle. One end of the main box is provided with a round opening and a rubber plug for closing the opening. On one side of the box are two rods on which slide a platen holding a record sheet and also an index finger. Both the platen and the index finger slide freely along the rods the full length of the box and both are easily removable by springing the slide clips off the rods.

To make a sand test with this instruments a small measuring cup is filled from the sand pile and emptied into the box. Water is added until the box is nearly full. The rubber stopper is inserted in the end of the box and holding the instrument in an inclined position with the glass receptacles uppermost the sand is washed down through the sieves by shaking the instrument in all directions. The glass receptacles, being inverted, do not fill with water while the sand is being shaken down through the screens. The instrument is next turned slowly over 180 deg. about its longitudinal axis and then turned on end, with the receptacles upright, and the sand is washed into them.

The depth of the sand in each receptacle is proportional to the quantity of each size of sand. The platen carrying the record sheet is now clipped on the slide rods and the index finger is snapped into position on the same rods. The form of record sheet generally used is shown in the accompanying drawing. It provides a variable length scale of one hundred parts on which percentage of the total sample may be read directly, even though the total volume of the sample may vary between rather wide limits.

The bottom line of the record sheet is placed opposite the bottom of the sand in the lowest receptacle and the index finger is moved along until it is in line with the top of the sand in the bottom receptacle. A line is then drawn with a pencil across the record sheet, using the lower edge of the index as a straight edge. The index is then moved up until it is opposite the bottom of the sand in the next receptacle. The platen is moved up until the pencil line just drawn coincides with the lower edge of the index. The index is then moved up to the top of the sand in the second receptacle and another line drawn across the record sheet along the lower edge of the index. By repeating this procedure there are produced on the record sheet a series of horizontal lines whose distances apart are equal to the depths of the sand in the six receptacles. The top line will cut the top diagonal line of the record sheet at some point depending upon the size and grading of the sample. At this point of intersection, representing 100 per cent, or all of the sand, a vertical line is drawn on the record sheet. This vertical line will intersect all the horizontal lines previously drawn. At this point of intersection may be read to the right the per cent retained on and to the left the per cent passing the various screens in the box.

The shaded bands on the accompanying record slip show the results of a standard analysis for a particular sand, allowing a two per cent variation from the mean. With such a diagram in his possession an inspector can tell at once whether the sand tested varies materially from the standard analysis established for that particular sand.

The time required to make a test with the instrument is about ten minutes on the average, including taking the sample, making the separation, drawing the record diagram, and cleaning out the instrument for another test. As compared with any other known method, this is very rapid.

*Abstracted from a paper presented before the American Concrete Institute, Feb. 17, 1916.

EARLY RAILWAY TRAVEL IN ENGLAND.—Rule (1). Any person desiring to travel from Liverpool to Manchester, or vice versa, or any portion of the journey thereof, must twenty-four hours beforehand, make application to the station agent at the place of departure, giving his name, address, place of birth, age, occupation and reason for desiring to travel.

GENERAL NEWS DEPARTMENT

ALL SECTION FOREMEN of the Duluth, South Shore & Atlantic were granted an increase in pay of $2.50 per month, effective May 1.

THE STATISTICAL STATEMENT issued by the American Railway Association for May 1 showed a total surplus of 59,657 cars, as compared with 52,274 for April 1 and 292,269 for May 1, 1915.

THE SENATE COMMITTEE ON INTERSTATE COMMERCE has acted favorably on the bill to increase the number of Interstate Commerce commissioners from seven to nine. Similar action was taken in the House of Representatives some time ago.

THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE held examinations in various cities on May 19, for a special agent to investigate the markets for railway supplies in South America and for a similar agent to visit Africa, Australasia and the Far East.

THE CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS has issued a small card for distribution in cities along its line showing the number of heads of families employed, the number of persons dependent upon these employees and the total monthly pay roll for these cities.

THE COLLEGE OF MECHANICAL AND ELECTRICAL ENGINEERING of the State University of Kentucky, Lexington, dedicated a monument to early American railroading on May 30. The monument is in the shape of a 25-ft. section of the original track of the Lexington & Ohio Railroad, the first railroad built west of the Allegheny Mountains.

THE OLD GUARD of the Nashville, Chattanooga & St. Louis, an association of employes and officials of the road who have been in the service since the Civil War, held its ninth annual meeting in Nashville recently, and decided to enlarge the membership by admitting anyone who had been in the employment of the road 35 years.

DURING A DISCUSSION in the House of Commons of the Canadian Parliament recently, the acting minister of railways stated that the expenditure on the Quebec bridge to date amounts to $18,257,621, of which $10,473,046 has been on the new bridge. The total cost of the structure, including the amount expended for the old bridge, is estimated at $27,000,000.

THE LONG ISLAND RAILROAD has issued a poster, printed in three colors, announcing that it will continue its campaign introduced last year against reckless driving of automobiles over grade crossings. It calls attention to the efforts made last year which were rewarded by the absence of a single fatal accident, and requests the assistance of the public for the coming season.

OF THE RECENT ORDER of 125,000 tons of rails ordered by the Pennsylvania for the lines east of Pittsburgh, all but 5,000 tons will be rolled to a 130-lb. section. This section is identical with the 125-lb. section adopted two years ago, with the exception that 1/8-in. of metal is added to the top of the head. The Bessemer & Lake Erie has also ordered a considerable tonnage of this same section.

THE SOUTHERN PACIFIC will discontinue the use of the name Sunset-Central Lines as the official designation of this group of railroads in Texas, and these roads will be known in the future as the Southern Pacific Lines. The Sunset-Central Lines include the Houston & Texas Central, the Galveston, Harrisburg & San Antonio, the Texas & New Orleans, the Houston, East & West Texas and the Houston & Shreveport. Similar action is contemplated with reference to the Sunset-Central Lines in Louisiana.

WITH THE OBJECT of placing in convenient and accessible form before those in the United States interested in or responsible for railway materials, the Bureau of Standards, Department of Commerce, in connection with its investigation of failures of railway material, has obtained copies of specifications for rails, axles, wheels and tires used in several European countries. These specifications are given in full, together with a digest and discussion, in Technologic Paper No. 61, "Foreign Specifications for Railway Material," just issued. The available data concerning the types and weights of foreign railway equipment, together with those concerning derailments and accidents abroad, are also included in the publication.

AMONG THE SIX EMPLOYEES of the Pennsylvania Railroad retired from active service on April 1 was Daniel Sullivan, crossing watchman at Titusville, Pa. He entered the service of the Pennsylvania as a brakeman in May, 1864, and was transferred to duty as crossing watchman at Titusville, in November, 1877.

F. D. UNDERWOOD, president of the Erie, has announced that any employees of the road called upon for military duty of any kind in the militia shall enjoy leave of absence with full pay, and that this time shall not be deducted from the regular vacation periods and shall not affect continuous service records. This order applies to all employees paid by the day, week or month, but not those paid by the piece, by the hour or by mileage.

A TRACK-REPAIR LABORER came in contact with poison ivy while mowing grass on a right of way, resulting in his sickness. While in bed, owing to his reduced power of resistance to disease, he contracted bronchitis, of which he died. The New York Appellate Division, in a proceeding under the Workmen's Compensation Act, held that his death was accidental within the meaning of the act, and not the result of an occupational disease and that compensation could be properly awarded.

A PRELIMINARY STATEMENT of the general results of the 1914 census of manufactures with respect to steel works and rolling mills has been issued by Sam L. Rogers, director of the Bureau of the Census, Department of Commerce. The statistics for 1914 covered a period of marked depression. The output of rails in the later year, not including rerolled or renewed rails, was 1,842,041 tons, valued at $54,009,918, as compared with 2,858,599 tons, valued at $81,128,295, in 1909. The production of rerolled or renewed rails decreased from 106,352 tons, in 1909, to 63,671 tons, in 1914, and of rail fastenings—splice bars, tie-plates, etc.—from 396,911 tons, in 1909, to 348,947 tons, in 1914.

THE TENNESSEE SUPREME COURT has held that a railroad is not liable for injury to a member of a section crew riding on a hand car in charge of the foreman who permitted it to run at high speed, the man being injured by the foreman's negligence in applying the brake suddenly. The court held that the foreman was not specially required to use the brake and that any of the men on the car might have used it. If the man had been directed to handle the brake himself the case would have been different. The railroad, having provided a safe roadbed, a hand car in good condition and having exercised due care in the selection of servants to operate it, was not liable for the neglect of the servants in such operation.

PLANS ARE DEVELOPING RAPIDLY for the annual convention of the Roadmasters' and Maintenance of Way Association, which will be held at the McAlpin Hotel, New York, on September 19 to 22 inclusive. The twenty-fourth floor of this hotel has been reserved for the convention and the exhibit of the Track Supply Association. While the program for the convention has not yet been completed, the annual banquet will be held on Thursday evening with several prominent railway men as speakers. Arrangements have also been made for a special train to convey the members of the association and their guests on an inspection trip over the lines of the Long Island Railroad on Thursday afternoon preceding the banquet.

CORRECTION

IN THE DESCRIPTION of the improved Buda-Wilson Bonding Drill published in the Maintenance of Way Section of the *Railway Age Gazette*, for April 21, page 915, the statement was made that this drill supersedes the "Hy-Duty" Wilson Drill. This is incorrect, as the Buda Company is prepared to furnish either drill according to the preference of the user.

PERSONAL MENTION

GENERAL

F. W. SMITH, JR., division engineer of the New York division of the Pennsylvania Railroad, has been appointed assistant superintendent of the New York division, effective May 1.

THEODORE SPEIDEN, JR., who has been appointed assistant general manager of the Nashville, Chattanooga & St. Louis, with headquarters at Nashville, Tenn., began railway work in May, 1899, in the engineering department of the Louisville & Nashville. He subsequently became roadmaster of the Nashville division, and while in that position had charge of the construction work done by company forces on the Lewisburg & Northern. He entered the service of the Nashville, Chattanooga & St. Louis as assistant superintendent of the Chattanooga division in 1914. On February 1, 1916, he was made superintendent of the Chattanooga and Nashville divisions.

R. L. GEBHARDT, division engineer of the New Jersey and Lehigh division of the Lehigh Valley, has been appointed trainmaster of the Seneca division with headquarters at Sayre, Pa. He was born at Easton on Sept. 9, 1882. After graduating from Lafayette College, he entered the service of the Lehigh Valley during the summer of 1908 as a draftsman on the engineering corps at Easton and was promoted to assistant engineer on the New Jersey & Lehigh division at Easton in 1909. He was again promoted to assistant division engineer at Easton in 1910. In 1911 he was appointed division engineer of the Auburn division at Auburn and in 1912 was returned to Easton as division engineer of the New Jersey & Lehigh division, which position he held up to April 15, 1916, the date of his latest appointment.

ELISHA LEE, who was appointed assistant general manager of the Pennsylvania Railroad, with headquarters at Philadelphia, Pa., on May 1, graduated from the Massachusetts Institute of Technology in 1892, and entered the service of the Pennsylvania in November of the same year as a rodman in the office of the division engineer of the Tyrone division. From August, 1895, to October, 1897, he was on leave of absence. In April, 1899, he was appointed assistant supervisor, and two years later was promoted to supervisor. In August, 1903, he was appointed assistant engineer in the maintenance of way department, and in April, 1907, he was promoted to principal assistant engineer on the Philadelphia, Baltimore & Washington. On March 24, 1909, he was appointed superintendent of the New York, Philadelphia & Norfolk, since which time he has been in the operating department.

CHARLES S. KRICK, who was appointed general superintendent of the New Jersey division of the Pennsylvania Railroad on May 1, graduated from Lafayette College in June, 1887, and entered the service of the Pennsylvania as a rodman on the Schuylkill division the following month. On December 14, 1890, he was appointed assistant supervisor on the Tyrone division and was transferred to the Philadelphia division in April, 1892. He was appointed acting supervisor about three years later and was promoted to supervisor in June, 1896. On January 1, 1903, he was made assistant engineer of the Erie and Susquehanna divisions and was later transferred to the Philadelphia division. He became principal assistant engineer of the Philadelphia, Baltimore & Washington, in January, 1906. In April, 1907, he was appointed superintendent of the New York Terminal division, since which time he has been in the operating department.

E. F. MITCHELL was appointed group engineer of the western group of the presidents' conference committee on federal valuation of railroads, with office at Chicago, Ill., effective May 1. He was born in July, 1864, and was educated in private schools. He entered railway service in 1882, as an employee of the construction department of the Pennsylvania. He remained with this road in various capacities in both the construction and maintenance departments until 1887. From 1887 to 1890, he was division engineer maintenance of way of the Norfolk & Western, and from 1890 to 1892, assistant engineer in charge of surveys and track construction and draftsman for the Denver & Rio Grande. He was engaged in private civil and mining engineering practice in Colorado until 1900, when he returned to the Denver & Rio Grande as assistant engineer. From 1901 to 1904 he was chief engineer of the San Luis Valley Land & Mining Company in Colorado, and from 1905 to 1912 was engineer of construction and chief engineer of the Missouri Pacific. For the past four years he has been engaged in private practice as consulting engineer.

GAMBLE LATROBE, who has been appointed general superintendent of the Philadelphia, Baltimore & Washington, was born at Baltimore, Md., on January 21, 1866, and began railway work on April 4, 1884, as a rodman on construction on the Philadelphia division of the Baltimore & Ohio. In August, 1887, he became a levelman on the Pennsylvania R. R. and in May of the following year entered the service of the Philadelphia & Reading at Williamsport, Pa. On October 2, 1889, he returned to the service of the Pennsylvania R. R. at Altoona, and was appointed assistant supervisor in February, 1890. From January, 1895, to April, 1902, he was supervisor, and from that date to March, 1908, he was division engineer of the Baltimore division. At that time he was appointed general agent and superintendent at Baltimore, since which date he has been in the operating department. He has recently been superintendent of the Baltimore division of the Northern Central with headquarters at Baltimore.

ENGINEERING

J. H. HARRIS, division engineer of the Manhattan division of the Pennsylvania Railroad has been appointed division engineer of the newly created New York division.

J. F. DONOVAN, division engineer of the Mahanoy & Hazleton division of the Lehigh Valley at Hazleton, Pa., has been appointed division engineer of the New Jersey & Lehigh division at Easton, Pa., succeeding R. L. Gebhardt, appointed trainmaster.

H. O. KELLEY, assistant engineer of the Evansville & Indianapolis, has been appointed division engineer, with office at Terre Haute, Ind. He was born at Lebanon, Ind., on July 17, 1890, and graduated from the Rose Polytechnic Institute in 1913. He entered railway service with the Chicago & Eastern Illinois in July of that year, and continued with that road until March 1, 1916, when, on the separation of the Evansville & Indianapolis from the Chicago & Eastern Illinois, he went with the latter property.

W. S. MOORE has been appointed engineer maintenance of way of the Louisville, Henderson & St. Louis, with headquarters at Louisville, Ky. He was born in Fresno, Cal., in 1886, and graduated from Vanderbilt University in 1907. He entered the employ of the Louisville & Nashville the following year as a rodman on the Memphis division. He was appointed engineer of terminals at Louisville in 1911, and assistant engineer, Pensacola, Fla., in 1912. He was appointed engineer maintenance of way of the Louisville & Atlantic (Louisville & Nashville) in 1913. He went to the Louisville, Henderson & St. Louis in November, 1915, on special work and was appointed to the newly created office of engineer of maintenance of way on April 17, 1916.

FRANK STRONG has been appointed division engineer maintenance of way of the San Pedro, Los Angeles & Salt Lake, with office at Salt Lake City, Utah, vice R. K. Brown, promoted. Mr. Strong was born at Philadelphia, Pa., on December 29, 1879, and graduated from Norwich University, Vermont, in 1902, as a civil engineer. He entered railway service in March, 1903, with the Pennsylvania. He was employed in the construction department of this road until 1909, during which time he was identified with the construction of the Pittsburgh terminal facilities, the Brilliant cut-off, and the New York tunnel and terminal work. In 1909 he joined the engineering staff of the Salt Lake Route. He has been engaged in location, construction, maintenance and valuation work for that road since that time.

R. K. BROWN was appointed engineer maintenance of way of the San Pedro, Los Angeles & Salt Lake, with headquarters at Los Angeles, Cal., on May 1. He was born in Cincinnati, Ohio, in 1876. When 16 years of age he entered the employ of the Pensylvania Lines West of Pittsburgh, as a rodman. During intervals between periods of employment he attended the Rensselaer Polytechnnc Institute at Troy, N. Y., from which he received his degree. After returning to the Pennsylvania Lines he was advanced to division engineer, with headquarters at Richmond, Ind. In 1902 he left the Pennsylvania Lines and went to Los Angeles, Cal., to become division engineer of the San Pedro, Los Angeles & Salt Lake. In the following year, when the Salt Lake route reached Salt Lake City, Utah, he was transferred to the latter city as division engineer maintenance of way of the Salt Lake division, which position he held until his recent promotion.

R. K. BROWN

C. R. ANDERSON has been appointed division engineer of the Mahanoy & Hazleton division of the Lehigh Valley with headquarters at Hazleton, Pa. He was graduaated from the Civil Engineering department of Lafayette College in 1907. In that year he entered the service of A. Pardee & Company, coal mining operators at Hazleton, as an assistant engineer. In 1908 he accepted a position in the engineering department of J. S. McIlvaine & Company, bridge contractors and erectors, Chambersburg, Pa., and in the next year entered the service of the Lehigh Valley as a transitman in the engineering department of the Mahanoy & Hazleton division. After serving as transitman for nearly two years, he was promoted to draftsman, which position he held for two years. In 1913 Mr. Anderson was promoted to the position of assistant the position of assistant division engineer. The early part of this year he was promoted to the position of supervisor of track on subdivision No. 2 of the Mahanoy & Hazleton division and served in that capacity until his recent promotion.

C. R. ANDERSON

F. L. WHEATON, engineer of construction of the Delaware, Lackawanna & Western, was appointed division engineer at Binghamton, N. Y., on April 19, succeeding Charles E. Wickham, deceased. After graduating from Thayer School of Engineering, Dartmouth College, in 1886, Mr. Wheaton entered railway service in August of that year as division engineer of construction with the Chicago, Rock Island & Pacific. From 1889 to 1891 he was assistant engineer of construction for the Lehigh Valley at Geneva, N. Y., from which time he was in private practice at Jersey City, N. J., until 1899. Following a year as resident engineer for the Chicago & Northwestern at Mason City, Iowa, he went with the Lackawanna in 1900, as assistant engineer, since which time he has been in charge of the construction of the New Bergen tunnel; the Hoboken terminal; the Hopatcong-Slateford cut-off and the Clark's Summit-Hallstead cut-off recently completed.

JOHN R. SEXTON, recently appointed division engineer of the Erie with headquarters at Meadville, Pa., was born January 18, 1889, at Long Branch, N. J. He was graduated from Rutgers College in 1911. He first entered railway service in the summer of 1910, when he served as a rodman on the Lehigh Valley. From August 1, 1911, to October 12, 1913, he was successively rodman, transitman and inspector on the New York Central & Hudson River. Upon leaving the latter road he went to Cleveland, Ohio, as resident engineer of the Erie, and was transferred later to Weehawken, N. J., in the same capacity. On April 1, 1915, he was appointed assistant division engineer of the Mahoning division, with office at Youngstown, Ohio. On May 1, 1916, he was promoted to division engineer of the Meadville division with office at Meadville, Pa., vice C. Bucholtz, promoted.

TRACK

WILLIAM STANCE KAMINSKI has been appointed roadmaster of the Northern Pacific, with headquarters at Duluth, Minn.

J. HOLLONQUIST, roadmaster of the Canadian Pacific, at Moose Jaw, Sask., has been transferred to Mission, B. C., vice J. Esslemont, deceased.

JOHN BOXFORD was appointed acting roadmaster of the fourth district of the Panhandle & Santa Fe, with headquarters at Slaton, Tex., on May 1, succeeding D. O'Connell, transferred.

J. H. BROWN has been appointed roadmaster of the Atchison, Topeka & Santa Fe, at Topeka, Kan., succeeding A. E. Hansen, deceased. Mr. Brown was formerly with the Union Pacific.

F. M. LEWIS has been appointed assistant supervisor on the Philadelphia division of the Pennsylvania Railroad, with headquarters at Enola, Pa., succeeding H. H. Kauffman, transferred.

JOHN MERRY, roadmaster on the Rocky Mountain division of the Northern Pacific, with headquarters at Missoula, Mont., has been transferred to the Yellowstone division, with office at Glendive, Mont.

C. S. ROZZELLE has been appointed assistant supervisor of the Illinois division of the Baltimore & Ohio Southwestern at Carlyle, Ill., in charge of track between East St. Louis and Xenia, effective May 1.

A. G. ARMSTRONG has been appointed assistant supervisor of the Indiana division of the Baltimore & Ohio Southwestern at North Vernon, Ind., in charge of the line between Seymour, Ind., and Jeffersonville, effective May 1.

J. M. COTTER has been appointed roadmaster and E. F. Kelley, master carpenter of the Spokane, Portland & Seattle, with headquarters at Vancouver, Wash., following the re-establishment of division headquarters at this point.

M. D. MORGAN has been appointed roadmaster of the Chicago, Rock Island & Pacific, with headquarters at Fairbury, Neb., vice F. Bokenkroger. C. C. Cunningham has been appointed roadmaster with headquarters at Liberal, Kan., vice A. Shumate.

CHARLES EWALD, yard foreman of the Cleveland, Cincinnati, Chicago & St. Louis at Hillsboro, Ill., has been appointed acting supervisor of District No. 2 of the St. Louis division, with headquarters at Mattoon, Ill., relieving John Barth, injured in a motor-car accident several weeks ago.

GEORGE B. SCHROYER has been appointed assistant supervisor on the New York division of the Pennsylvania Railroad with headquarters at Jersey City, N. J. George F. Walter has been appointed assistant supervisor on the Delaware division at Clayton, Del. Joshua F. Hunter has been appointed assistant supervisor of subdivision No. 3 on the Maryland division.

H. B. WELSH, supervisor of the Pennsylvania Railroad at York, Pa., was appointed supervisor at Reading, Pa., on May 10, succeeding T. E. Lightfoot, transferred. F. E. Putney, supervisor at Freeport, Pa., succeeds H. B. Welsh. W. B. Carpenter, supervisor at Reynoldsville, Pa., has been transferred to Earnest, Pa., succeeding W. S. Springer, transferred. E. L. Hoopes has been appointed supervisor at Osceola Mill, Pa., succeeding F. M. Robb, transferred.

CHARLES C. CUNNINGHAM, recently appointed roadmaster of the Chicago, Rock Island & Pacific, with headquarters at Liberal, Kan., was born in 1887 at Washington, Iowa. He gradu-

ated from Yale in 1909, and entered the service of the Rock Island in August, 1909, as a rodman. He was later transitman, and successively assistant engineer at Topeka, Kan., Kansas City, Mo., and Dalhart, Tex. He was appointed roadmaster at Liberal, Kan., on April 26, 1916, vice A. Shumate, who resigned to accept service with another company.

J. D. ALBRIGHT has been appointed acting roadmaster on the Western division of the Duluth, South Shore & Atlantic at Ewen, Mich., with jurisdiction between Nestoria, Mich., and Superior, Wis., succeeding August Mase, resigned. Mr. Albright entered the employ of the Duluth, South Shore & Atlantic as section laborer on February 17, 1892, two years later he was promoted to section foreman and on June 1, 1911, he was appointed roadmaster of the Western division. He resigned this position on May 1, 1915, and was reappointed on April 1, 1916, as noted above.

W. P. ABBOTT has been appointed assistant supervisor on that part of the Ohio division of the Baltimore & Ohio Southwestern, between Madisonville, Ohio and Chillicothe, effective May 1. J. Hewes, Jr. has been appointed assistant supervisor at Chillicothe, Ohio, with jurisdiction between Chillicothe, Ohio, and Portsmouth. D. Hubbard has been appointed assistant supervisor at Athens, Ohio, in charge of track between Hamden, Ohio, and Belpre. C. E. Newhouse has been appointed assistant supervisor at Blanchester, Ohio, with jurisdiction over the line between Blanchester, Ohio and Columbus, including the Hillsboro branch.

PURCHASING

R. O. WOODS has been appointed division storekeeper of the Mobile & Ohio, with office at Meridan, Miss., vice M. R. Ducey, resigned to accept service with another company.

SAMUEL WILSON SAYE has been appointed purchasing agent of the Georgia & Florida, with headquarters at Augusta, Ga., succeeding J. H. Conley, assistant auditor. He was born at Athens, Ga., on August 4, 1893. On January 8, 1912, he began railway work as a stenographer on the Southern at Columbia, S. C. The following April he entered the service of the Georgia & Florida as a stenographer in the accounting department, and three months later he became secretary to the general manager. On February 1, 1916, he was appointed commercial agent, with headquarters at Vidalia, Ga., which position he held at the time of his recent appointment as purchasing agent at Augusta of the same road.

OBITUARY

A. E. HANSEN, roadmaster, Atchison, Topeka & San Fe, Topeka, Kan., died on April 19. Mr. Hansen had been a roadmaster on the Santa Fe for a number of years. He had also been prominent in the Roadmasters' and Maintenance of Way Association, being president of that organization several years ago.

HENRY ROHWER, a pioneer engineer of the West, died at St. Louis, Mo., on May 5, at the age of 68 years. He was born in Germany and came to this country in 1869. He held various engineering positions with the Burlington, the Oregon Short Line, the Omaha Belt and other roads. From March 1, 1901, to January 1, 1905, he was chief engineer of the Missouri Pacific. Since that time he was engaged in private practice as consulting engineer.

CHARLES E. WICKHAM, division engineer of the Delaware, Lackawanna & Western at Binghamton, N. Y., died April 16, after a lingering illness. He was born at Southampton, England, on July 21, 1863, and was educated at the State University of Iowa. He entered railway service as a chainman on the Burlington, Cedar Rapids & Northern, in 1884. In 1887 he was appointed office engineer of the Kansas & Colorado, after which he was employed with the Chicago, Rock Island & Pacific, and on the Mexican Southern. He was appointed superintendent of construction of the Peoria Terminal Ry. in 1892, becoming roadmaster of the Chicago, Rock Island & Pacific in 1893 and division engineer of this same road in 1897. On January 1, 1901, he was made general roadmaster in charge of lines east of the Missouri river, from which position he went to that of division engineer of the Delaware, Lackawanna & Western.

CONSTRUCTION NEWS

THE ANTHONY & NORTHERN will soon commence the construction of a branch north from Larned, Kan., an indefinite distance.

THE ATLANTIC NORTHERN has awarded a contract to Campen & Company to rebuild 20 pile trestle bridges having a total length of about 1,625 lineal feet. Company forces are also at work retieing, ditching and ballasting the road.

THE ATCHISON, TOPEKA & SANTA FE has completed plans for a passenger station to be built at Colorado Springs, Colo. The structure will be a two-story building, 90 ft. by 301 ft., with brick exterior stone trimmings, tile roof and tile interior. It will include a depot, baggage room, lunch room and dining room on the first floor and railroad offices on the second floor. The entire first floor will have tile flooring, except the baggage room, which will have a mastic flooring. The cost is estimated at $175,000.

The Atchison, Topeka & Santa Fe will spend about $330,000 on improvements at Las Vegas, New Mex., which will include a 34-stall reinforced concrete roundhouse, a brick power house, 35 ft. by 70 ft., a 600-ton coal storage and service plant, a lavatory building, 24 ft. by 120 ft., a 100-ft. concrete cinder pit and incidental track changes.

The Atchison, Topeka & Santa Fe is making a survey for a branch line from Lubbock, Tex., west for an indefinite distance.

THE ATLANTIC COAST LINE has submitted a proposition to residents of Orangeburg, S. C., to build a new passenger station there at an estimated cost of $11,000. The railroad also proposes to move the present passenger station to a suitable place for future use as a freight house.

THE BALTIMORE & OHIO will build a new freight house at Bellaire, Ohio. The proposed structure is to be 40 ft. by 160 ft., with a covered platform 16 ft. by 80 ft. and an open platform 16 ft. by 190 ft. The company also plans to build a two-story brick office building, 40 ft. by 40 ft., at this point.

THE BOSTON & ALBANY is planning to build at Worcester, Mass., a new freight house 450 ft. long and 30 ft. wide, which will be used exclusively for outbound freight.

THE CENTRAL OF NEW JERSEY has asked for bids on June 1 for the construction of a new terminal station on Broad street, Newark, N. J. The proposed structure is to be 67 ft. high, 300 ft. wide, including a concourse 166 ft. long, and station and platforms 1,040 ft. in length and of steel frame construction, with brick and terra cotta walls on concrete foundations.

THE CHARLESTON & WESTERN is planning to build a new brick freight station at Anderson, S. C., by company forces.

THE CHICAGO & NORTHWESTERN has received bids for moving, remodeling and constructing additions to the present passenger station at Fond du Lac, Wis. The estimated cost of these improvements with track changes is about $68,000.

The Chicago & Northwestern and the Chicago, St. Paul, Minneapolis & Omaha have jointly appropriated about $130,000 for improvements to their shops at Sioux City. The work will include the installation of four 300-hp. boilers, a boiler washing plant for a 38-stall engine house, and the construction of a cinder pit and approach. Part of the above appropriation will be used for the purchase of new tools.

THE CHICAGO, BURLINGTON & QUINCY has awarded to Westinghouse, Church, Kerr & Co., New York, a general contract for the erection of additional shop buildings at West Burlington, Iowa. The work will be done jointly by this company and the Burlington's own forces.

The Chicago, Burlington & Quincy has awarded a contract to the Railroad Water & Coal Handling Company, Chicago, Ill., for the construction of a water station at Yates City, Ill., which will involve the laying of 13,000 ft. of 8-in. cast-iron pipe and a 30-h.p. oil engine directly connected to a triplex pump.

THE CHICAGO GREAT WESTERN has completed a survey for a line between Rochester, Minn., and Mantorville, which, if con-

structed, will save about 25 miles in the distance between Rochester and St. Paul.

THE CHICAGO, INDIANAPOLIS & LOUISVILLE is preparing plans for a stone depot to be built at Monon, Ind., at a cost of from $15,000 to $20,000.

THE CHICAGO, MILWAUKEE & ST. PAUL has awarded a contract for ballasting and bank widening between Alamo, S. D., and Aberdeen to the Peter Nelson Company, Minneapolis, Minn.

The Chicago, Milwaukee & St. Paul will build a new passenger and freight station at Kimball, S. D., by company forces at a cost of about $6,000.

The Chicago, Milwaukee & St. Paul, the Chicago, Burlington & Quincy and the Davenport, Rock Island & Northwestern have jointly agreed to construct a union passenger station, a new freight house and yards, depress the main-line tracks and remove switching tracks from the river front at Davenport, Iowa. Work on the freight house and yards will be begun about July 1, with the prospect of their completion this year. The union depot will be built in 1917, and the subway the following year. The total cost of these improvements has been estimated at $500,000.

The Chicago, Milwaukee & St. Paul is resurveying its line from Blackfoot Junction, Mont., east, and expects to ask for bids on the work some time in June.

THE CHICAGO, ST. PAUL, MINNEAPOLIS & OMAHA has awarded a contract to A. Guthrie & Co., St. Paul, Minn., to erect an 800-ft. bridge across the Chippewa River at Chippewa Falls, Wis.

The Chicago, St. Paul, Minneapolis & Omaha has awarded a contract to the La Crosse Dredging Company, Minneapolis, Minn., to fill the trestle approaches to its bridge over the Mississippi River at St. Paul, Minn., requiring the deposit of 60,000 cu. yd. of material.

The Chicago, St. Paul, Minneapolis & Omaha has awarded a contract to the George A. Fuller Company, St. Paul, Minn., for the erection of a new office building on the site of the present offices, involving the construction of an eight-story fireproof steel-frame building, 128 ft. by 99 ft. The building will be faced with Bedford stone for the first story and with brick for the other stories, and will cost about $400,000.

THE DELAWARE & HUDSON has awarded a contract to the C. P. Boland Company, Albany, N. Y., for an extension to its present office building on the Plaza at Albany, N. Y. The structure will be 50 ft. by 184 ft. in area and four stories high, including an attic, and will be built of granite, steel and concrete at an estimated cost of $260,000.

THE ERIE has awarded a contract to Kidder & McCourt for the grading for a new yard at Akron, requiring the handling of 72,000 cu. yd. of material.

The Erie has received bids for the construction of a roundhouse at County Road on the Jersey meadows, Jersey City, N. J. The structure is to have from 35 to 40 stalls and is to be of frame construction.

THE FLORIDA EAST COAST is constructing division terminal facilities at Buena Vista, Fla., to remove the present facilities from the center of the city of Miami. The work includes the laying of 11½ miles of track, and the erection of a 10-stall roundhouse with an 85-ft. turntable, a small machine shop and other auxiliary division shop buildings. The total cost of the work is estimated at $200,000. All work is being done by company forces.

THE GREAT NORTHERN contemplates making improvements at Whitefish, Mont., at an estimated cost of $35,000, which will include the construction of a 15-stall, 116-ft. frame extension to the roundhouse, an extension to the boiler house and cinder pit, and some additional track work.

The Great Northern has awarded a contract for the construction of timber snowsheds on the east slope of the Cascade mountains to the W. J. Hoy Company, St. Paul, Minn., on the west slope to Grant Smith & Company. A contract was also let to Henry & McFee, Seattle, Wash., for concrete sheds on the west slope.

The Great Northern has awardede a contract for the construction of 25 miles of new line from Lambert, Mont., west, to A. Guthrie & Co.

THE GULF COAST RAILWAY has awarded a contract to E. B. Duncan, Ocala, Fla., to build 28.5 miles of new line from Venice, Fla., on the Seaboard Air Line southeast to Placida on the Charlotte Harbor & Northern, and work is now under way. The company was organized last year by some of the officers of the Southern Investment Company, Richmond, Va., L. M. Williams, Richmond, being president.

THE GULF, COLORADO & SANTA FE will build a new station at Bay City, Tex., at an estimated cost of $15,000.

THE HOCKING VALLEY has awarded a contract to Fritz, Rumer, Cooke, Grant & Co., to build a 15-stall brick engine house with wooden roof, at South Parsons avenue, Columbus, Ohio.

THE MICHIGAN CENTRAL has awarded a contract to the Wallbridge-Aldinger Company, Detroit, Mich., for the construction of a roundhouse, an oil house, a small machine shop and a coal chute at Montrose, Ont. The buildings will be of concrete and brick construction.

THE MINNEAPOLIS & ST. LOUIS and the Chicago, Milwaukee & St. Paul will jointly erect a viaduct, about 1,700 ft. long, over the tracks on West Lake street, Minneapolis, Minn.

THE NEW ORLEANS, MOBILE & CHICAGO, W. F. Owen, receiver, has been authorized by Judge Toumlin in the Federal District Court at Mobile, Ala., to start the construction of a 34-mile extension from Middletown, Tenn., north to Jackson, the estimated cost being between $700,000 and $800,000.

THE NEW YORK CENTRAL has received bids for the construction of a new passenger station and facilities at Poughkeepsie, N. Y., at an estimated cost of $250,000.

THE NORFOLK & WESTERN has let a contract to W. W. Boxley & Co., Roanoke, Va., for the construction of 3 miles of second track between Joe, W. Va., and Alnwick. This work will consist of approximately 131,000 cu. yd. of excavation, of which 71,000 cu. yd. is borrow; also from 800 to 1,200 cu. yd. of class "A" masonry.

THE NORTHERN PACIFIC has awarded contracts to A. Guthrie & Co., St. Paul, Minn., for the extension of the Sunnyside branch from Grand View, Wash., 12 miles to Gibbons, and of the Sincoe branch 9 miles to White Swan, Wash.

THE OREGON-WASHINGTON RAILROAD & NAVIGATION COMPANY is receiving bids for the construction of a frame, nine-stall roundhouse with brick exterior at La Grande, Ore. The structure will cost about $30,000.

THE PENNSYLVANIA LINES are constructing an eastbound running track between Marion, Ohio, and Harvey, a distance of five miles, reducing the grade from 0.5 per cent to 0.3 per cent, and requiring the handling of 50,000 cu. yd. of earth and 5,000 cu. yd. of rock. The grading contract has been awarded to P. T. Clifford & Son, Valparaiso, Ind., and the track work is being done by company forces.

THE PERE MARQUETTE contemplates the construction of an additional freight yard at Flint, Mich., which will contain about seven miles of new track, a coal dock, water station and four-stall engine house, at an estimated cost of $100,000.

THE PITTSBURGH & LAKE ERIE is double tracking about two miles of its line between Fayette City, Pa., and Newell.

THE SEABOARD AIR LINE and the ATLANTIC COAST LINE will build a joint passenger station of tapestry brick trimmed with Indiana limestone, at Ocala, Fla., with umbrella sheds 250 ft. long along each railway and connected to the main roof of the station.

THE ST. LOUIS & SAN FRANCISCO and the Missouri, Kansas & Texas have jointly let a contract to H. E. McCart, Durant, Okla., to build a brick passenger station with stone trimmings, 122 ft. by 79 ft., at Durant, the estimated cost being $30,000.

RAILS

THE MAINE CENTRAL has recently placed orders for 7,500 tons of rails.

THE VIRGINIAN has ordered 8,000 tons of rails from the Pennsylvania Steel Company.

THE PERE MARQUETTE has ordered 15,000 tons of rails from the Algoma Steel Corporation.

The Western Maryland has ordered 2,000 tons of rails from the Pennsylvania Steel Company.

The Havana Central has ordered 5,000 tons of rails from the United States Steel Corporation.

The Chesapeake & Ohio has ordered 10,000 tons of rails from the Pennsylvania Steel Company.

The Norfolk & Western has ordered 18,000 tons of rails from the United States Steel Corporation.

The New York, New Haven & Hartford has ordered 20,000 tons of rails from the Bethlehem Steel Company.

The Cincinnati, Hamilton & Dayton has ordered 5,000 tons of rails from the United States Steel Corporation.

The Erie has ordered 25,000 tons of rails from the United States Steel Corporation in addition to orders previously reported.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 14,000 tons of rails for 1917 delivery from the Illinois Steel Company.

The Ann Arbor has ordered 1,500 tons of 85-lb. rail from the Lackawanna Steel Company for delivery in May, June and July, 1917.

The Boston & Maine has ordered 8,000 tons of rails from the Pennsylvania Steel Company and 10,000 tons from other companies.

The Texas & Pacific has ordered 14,000 tons of open-hearth rails from the Tennessee Coal, Iron & Railroad Company for 1917 delivery.

The Chicago Great Western has ordered 4,000 tons of open-hearth rails and 4,450 tons of Bessemer rails from the Illinois Steel Company.

The Chicago & Eastern Illinois has arranged with the Illinois Steel Company for the delivery of 10,000 tons of 90-lb. rails in the spring of 1917.

The Philadelphia & Reading has divided an order for 25,000 tons of 100-lb. rails for 1917 delivery between the Bethlehem Steel Company, the Carnegie Steel Company, the Lackawanna Steel Company and the Pennsylvania Steel Company.

The Lake Superior & Ishpeming has ordered 3,500 tons of rails from the Illinois Steel Company. It has also placed orders with the Lackawanna Steel Company for May, 1917, delivery for 3,500 tons of 85-lb. rails, 9,800 pairs of angle bars, 9,800 Abbott joint plates, 1,300 kegs of spikes and 350 kegs of bolts.

STRUCTURAL STEEL

The Western Maryland has ordered 1,200 tons of bridge material from the McClintic-Marshall Company.

The Chicago Union Station Company has ordered 148 tons of I-beams from the Scully Steel & Iron Company.

The Baltimore & Ohio has ordered 600 tons of steel for coal pockets near Baltimore from the Hedden Iron Construction Company.

The Maine Central has divided an order for 550 tons of bridge material between the American Bridge Company and other shops.

The Duluth & Iron Range has ordered 601 tons of steel from the American Bridge Company for an ore car repair shop at Two Harbors, Minn.

The Missouri Pacific has placed orders with the American Bridge Company for 234 tons of steel for three 90-ft. turntables and 432 tons for various bridges.

The Southern Railway has ordered 1,750 tons of bridge steel from the American Bridge Company, 500 tons from the Fort Pitt Bridge Works, and 450 tons from L. F. Shoemaker & Co.

The Chicago, Milwaukee & St. Paul has ordered 108 tons of steel from the Fort Bridge Works for widening the Ashland avenue subway, Chicago, for a third track, and 126 tons of steel from the Jones & Laughlin Steel Company for a bridge over tracks at West Lake street, Minneapolis, Minn.

SUPPLY TRADE NEWS

C. J. Blair, president of the Kennicott Company, Chicago, died in that city on May 10. He was born at Michigan City, Ind., on April 6, 1845, and had been active in the commercial life of Chicago, being senior vice-president of the Corn Exchange National Bank, Chicago, for 13 years preceding his death.

The Barrett Company, having been convinced that with the workmanship properly safeguarded a Barrett specification roof will last for a minimum period of 20 years without repairs, will henceforth give a twenty-year surety bond guaranty without charge on all Barrett specification roofs of 50 squares or more in the United States and Canada, in towns of 25,000 and over, and in smaller centers where its inspection service is available, provided the roof is laid by a roofing contractor satisfactory to it and in strict accordance with the Barrett specifications dated May 1, 1916, and subject to the inspection and approval of the Barrett Company. This surety bond will be issued by the U. S. Fidelity & Guaranty Company of Baltimore.

The Q. & C. Company, New York, has issued the following announcement relative to Bonzano rail joint patents: "In answer to numerous inquiries regarding possible infringement of the so-called Thompson patents by several recent designs of Bonzano rail joints, we herewith give notice that after careful investigation and through advice of counsel, we have taken, from the owners of the Thompson-Thompson patents, a license for the exclusive manufacture and sale of Bonzano rail joints with reinforced heads, covered by the Thompson-Thompson patents. In view of the above, our customers need have no further consideration as to any possible infringement on account of the reinforcing of the heads of our Bonzano joints. The Bonzano joints, which include the Thompson features of reinforcement of the head, will hereafter be known as the "Bonzano-Thompson rail joints."

TRADE PUBLICATIONS

Building Materials.—E. M. Long & Sons, Cadiz, Ohio, have issued an attractive 24-page booklet describing their lumber and other products, including O. G. fir gutters used extensively on railway buildings.

Wheelbarrows.—The Kilbourne and Jacobs Manufacturing Company has issued a 30-page catalog, No. 41, describing its line of steel and wood wheelbarrows, concrete carts, drag and wheel scrapers, dump cars and plows.

Concrete Posts.—The Ohio Post Mold Company, Toledo, Ohio, has issued a 24-page pamphlet describing the uses and advantages of posts made in the Ohio post molds and machines. These posts are of a "T" shape with a rod in each corner.

Gasolene Hoists.—The Lidgerwood Manufacturing Company has issued Bulletin No. 16, illustrating and describing its hoists operated by gasolene engines. These hoists are designed for use where electric current is not available, and where coal and water suitable for boiler use are difficult to obtain.

Fence Posts.—The National Concrete Machinery Company, Madison, Wis., has issued a 16-page illustrated pamphlet describing the use and manufacture of concrete fence posts for railroads. The National power mixer and fence post machine is described and the forms and reinforcement used and method of manufacture are explained in detail.

Tie Tamping Outfits.—The Ingersoll-Rand Company has issued a bulletin on the use of the pneumatic tie tamper on steam and electric railways. The first 12 pages are devoted to a description of the methods and results obtained with these tie tampers on various roads with numerous illustrations showing exactly how the machines are handled. The remaining 12 pages are devoted to a description of the equipment, including the tie tamper, hose, the two-tool and four-tool gasoline engine compressor cars, the two-tool electric compressor car and miscellaneous equipment.

How Do You Like
The Initial Number of
Railway Maintenance Engineer?

The monthly MAINTENANCE OF WAY Section of the RAILWAY AGE GAZETTE and RAILWAY ENGINEERING AND MAINTENANCE OF WAY (a monthly paper established in 1884 as the Roadmaster and Foreman) are now combined to make one powerful medium to promote efficiency and economy in railway maintenance work.

This bigger, better publication will continue to assist you in solving many of your knotty maintenance of way problems and keep you informed on new materials and labor-saving devices.

Among the measures to be adopted to attain the desired end are:

(1) Discussions of means of increasing the efficiency of track labor (a) by more experienced supervision; (b) by the reorganization of forces; (c) by equating lengths of section (d) by adopting improved methods of performing work; (e) by the more uniform distribution of work throughout the year; (f) and by other means which may be developed by different railways from time to time.

(2) Promotion of the use of labor-saving devices for all branches of maintenance of way work, including the adoption of motor cars, tamping machines, locomotive cranes, concrete mixers and other mechanical, rather than manual, methods.

(3) Discussion of methods of training men for promotion to positions as foremen, supervisors, etc., through the system of track apprentices, assistant foremen and other plans.

(4) Development of the methods of building and maintaining the smaller passenger stations and other buildings for which the maintenance department is responsible.

(5) Descriptions of ways of handling construction problems commonly assigned to the maintenance of way department, including track changes, grade reduction, the addition of new tracks and reconstruction of bridges under traffic and other like improvement work.

(6) Articles on the progress in the science of wood preservation.

(7) A monthly record of developments in the use of special materials and appliances, such as new and improved tools; and new track, bridge and other materials.

(8) Presentation of the rapidly changing conditions of water service, including the design of new equipment and the selection of fuels.

(9) Discussion of the distribution and reclamation of maintenance of way materials.

(10) Detailed reports of the conventions of the roadmasters', the bridges' and buildings', the painters' and the wood preservers' associations. (The four March convention daily issues of the *Railway Age Gazette*, which will contain verbatim reports of the proceedings of the annual convention of the American Railway Engineering Association, will be sent to all RAILWAY MAINTENANCE ENGINEER subscribers.)

(11) Contests on subjects of live interest. Prizes will be awarded for the best papers presented as an incentive to the man out on the line to present his ideas for the other men.

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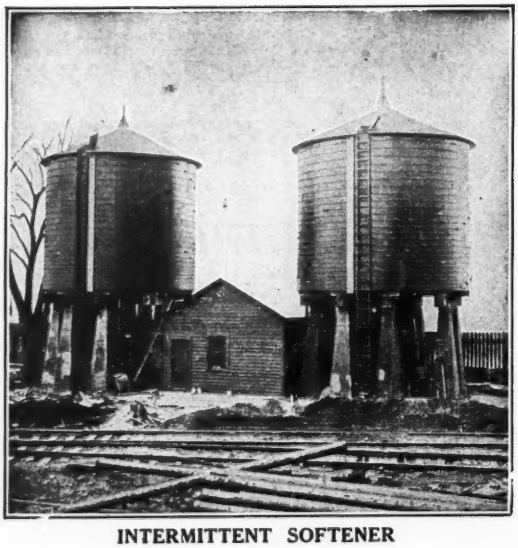

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STATEMENT of the ownership, management, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering and Maintenance of Way*, published monthly at New York, N. Y., for April 1, 1916.

State of New York } ss.
County of New York }

Before me, a notary public in and for the State and county aforesaid, personally appeared Fred W. Nolting, who, having been duly sworn according to law, deposes and says that he is the Secretary of the Railway Periodicals Co., Inc., publishers of *Railway Engineering and Maintenance of Way* and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
   Publisher, Railway Periodicals Company, Inc., 52 Vanderbilt avenue, N. Y. City.
   Editor, Benjamin Norton, 2 Spring street, New Rochelle, N. Y.
   Managing Editor, George S. Hodgins, 390 Wadsworth avenue, N. Y. City.
   Business Manager, Joseph A. Kucera, 52 Vanderbilt avenue, N. Y. City.
2. That the owners are:
   Owner—Railway Periodicals Company, Inc., 52 Vanderbilt avenue, N. Y. City. Stockholders holding 1 per cent or more of total amount of stock: Ernest C. Brown, 52 Vanderbilt avenue, N. Y. City, and Charles S. Myers, 324 East 26th street, Brooklyn, N. Y.
3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages or other securities are: None.
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also in cases where the stockholder or security holder appears upon the books of the company as Trustee or in any other fiduciary relation, the name of the person or corporation for whom such Trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as Trustees hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

RAILWAY PERIODICALS COMPANY, INC.,
FRED W. NOLTING, Secretary.

Sworn to and subscribed before me this 29th day of March, 1916.
[SEAL]
ANDREW O. REIMS.
Notary Public, Kings County, No. 62; Commission expires March 30, 1916.

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Side View

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Reeves Wood Preserver is treating plant and preservative in one. The test on your desk will prove this beyond any question of doubt. Write for the free testing outfit.

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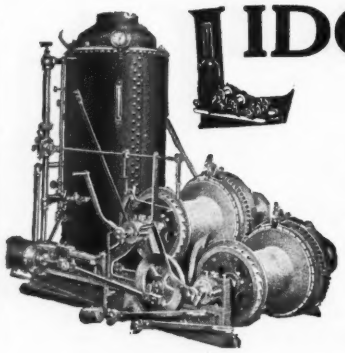

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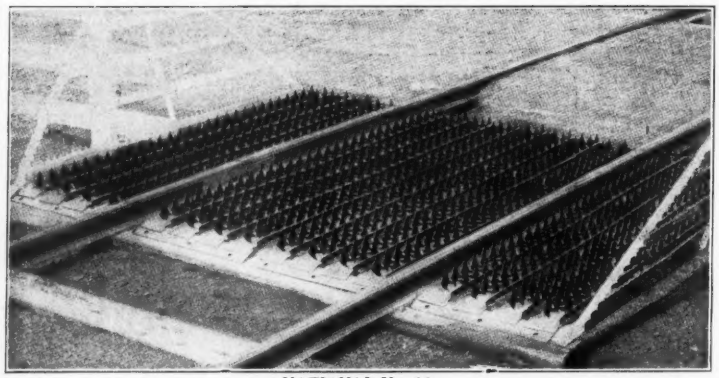

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Any ordinary section crew—experienced or not—can use a Northfield Mixer successfully. It's simple in construction and operation- has no complex parts and requires no skill to use. Nothing about it can give trouble and it's strong and durable. Stands the hardest service. The Northfield is used and approved by the best railway engineers. It is a proven success for the short concrete jobs that are now being done by hand. Used for making piers, back walls, sidewalks, pedestals, signal pits, patchwork, box culverts, turn table foundations, etc.

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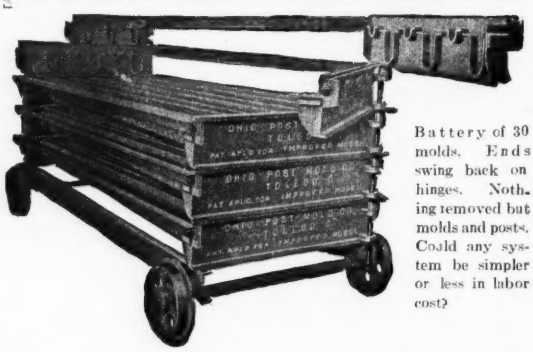
Concrete Post Molds



Battery of 30 molds. Ends swing back on hinges. Nothing removed but molds and posts. Could any system be simpler or less in labor cost?

Did you see Concrete Post Committee's Report Last Year?

Did you Notice the Test on Different Types of Concrete Posts?

Didn't type R (which were posts made with our molds) show up the best?

Write us for a copy of this test as published in the Rail Gazette.

Our system is the most economical and practical on the market.

It has been tried out for seven years.

If you are interested in concrete posts for your Right of Way, write for our catalog.

Ohio Post Mold Co.

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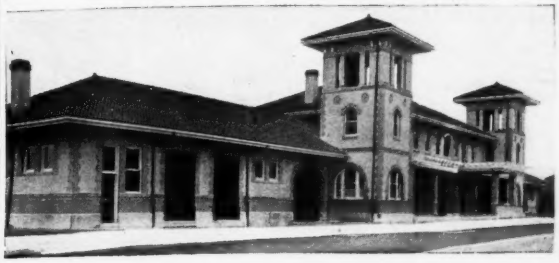

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Metal gutters are expensive—not only in first cost—but also in final costs; for there are maintenance and upkeep charges. Metal gutters cannot stand up against corrosion, acid fumes and chemical action of water. That's why railroads are specifying

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Because they resist decay; because they last three times as long as metal gutters; because the upkeep charges are nil; because they can be built into the building (see illustration below). There's a double saving in O. G. Fir Gutters. Write and let us explain in detail—our booklet will accompany our letter.

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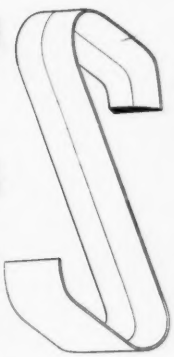

is the annual purchase of one large Western Railroad. This form of Tie Checker is an improvement over the old "S" style. We furnish the latter, however, on request.

Start Tie conservation now by using this new "Z" iron. Adopted by many leading roads.

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Model 15 Marion Ditcher on Canadian Pacific Railway

Three Big Marion Advantages

FIRST: *Independent Boom Engines.* A Marion Ditcher is able to dig through a considerably wider range because of its independent boom (or crowding) engines, thereby saving time of moving back and forth along the bank. It is also able to dig much harder material for the same reason, because of the more positive action of the dipper handle.

SECOND: *Independent Swinging Engines.* A Marion Ditcher is better able to hold its position on curves while digging. The swinging motion is positive in either direction and is not controlled by friction or similar devices.

THIRD: *A Marion Ditcher may be easily changed into a small Revolving Steam Shovel for work on the ground.* A truck frame for railroad wheels or traction wheels can be substituted for the regular ditcher truck frame, and the ditcher becomes a revolving shovel, suited to a revolving shovel's wide range of work.

These three are only a few of the many points of Marion Ditcher Superiority. Marion Excavating Machinery is being used on hundreds of railroads in the United States and abroad, which is good evidence of its efficiency.

Marion

We Make Excavating Machinery of Every Description

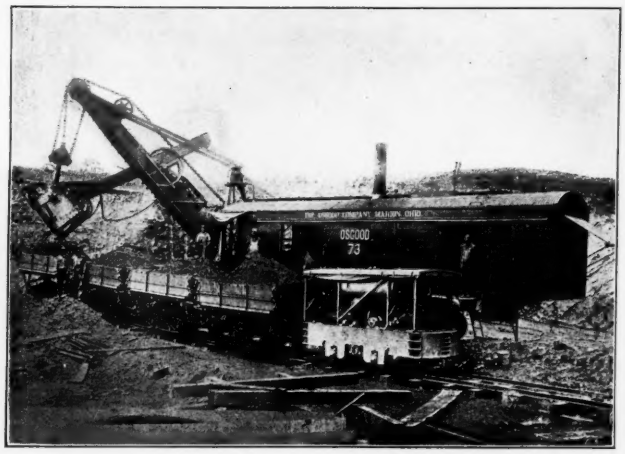
Branches:
Atlanta, Chicago, New York, San Francisco, Seattle

THE MARION STEAM SHOVEL COMPANY
Established 1884 **MARION, OHIO**
130

The OSGOOD "73"

3½ yard Steam Shovel is the practical shovel for HEAVY RAILROAD WORK.

Shipping weight 82 tons.



This shovel is new and modern in every respect, and embodies all the latest features in steam shovel construction, such as steel gears with machine cut teeth; manganese racks and pinions for dipper handle; manganese dipper front with renewable manganese lip; cast steel swinging circle; heavy front end construction; especially strong boom; large boiler and water tanks; long car frame; enclosed firing platform; steam hoisting friction; by-pass throttle, etc. In fact, all the improvements that have been found desirable for strength, capacity, maintenance and ease of operation.

Steam Shovels, all sizes, Deep Water and Ditching Dredges

THE OSGOOD COMPANY, MARION, OHIO

EASTERN OFFICE: 51 STATE ST., ALBANY, N. Y.

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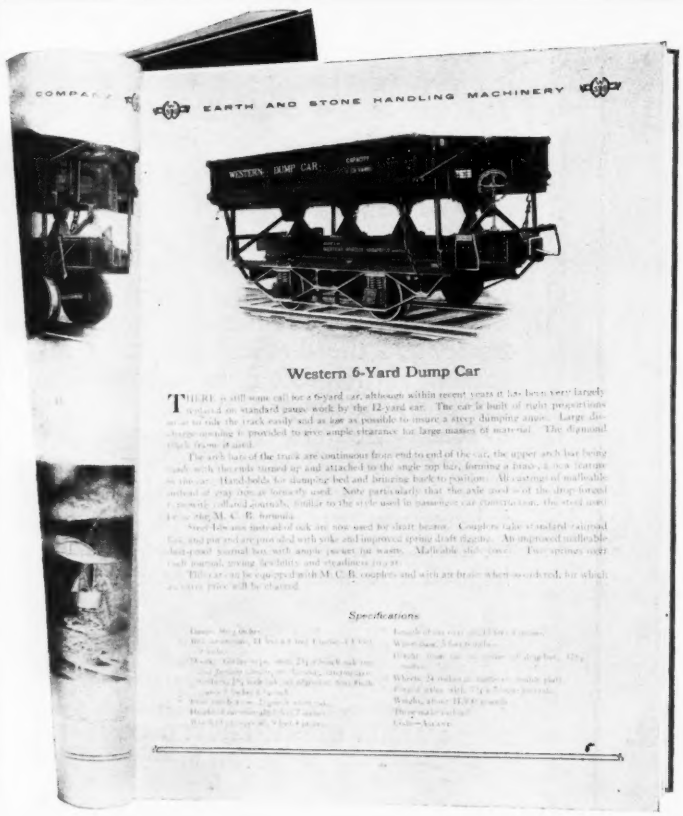
EARTH AND STONE HANDLING MACHINERY

Western 6-Yard Dump Car

THERE is still some call for a 6-yard car, although within recent years it has been very largely replaced on standard gauge work by the 12-yard car. The car is built of right proportions so as to ride the track easily and as low as possible to insure a steep dumping angle. Large discharge opening is provided to give ample clearance for large masses of material. The diagonal truss is used.

The arch bars of the trucks are continuous from end to end of the car, the upper arch bar being made with the ends turned up and attached to the angle top bar, forming a truss, a nice feature in this car. Hand-holds for dumping bell and bringing back to position. All castings of malleable instead of gray iron as formerly used. Note particularly that the axle used is of the drop forged I section, offered recently, similar to the style used in passenger car construction, the steel used being the M. C. B. formula.

Steel bolsters instead of oak are now used for draft beams. Couplers take standard railroad link, and pin and are provided with yoke and improved spring draft rigging. An improved malleable hand-proof journal box, with ample packet for waste. Malleable shoe keys. Two springs over each journal, giving flexibility and steadiness to car.

This car can be supplied with M. C. B. couplers and with air brake when so ordered, for which an extra price will be charged.

Specifications

Read This!

Our latest Catalog No. 40 is full of the kind of information you are looking for regarding Dump Cars and Machinery for Handling Earth and Stone.

A small fortune was spent to give you this finely illustrated and carefully worked out data on railroad construction.

It answers many of the questions which come up in connection with railroad work.

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Western Wheeled Scraper Co.
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